COMPREHENSIVE SURVEY OF 3,000 ACRES OF ATLANTIC WHITE CEDAR [*CHAMAECYPARIS THYOIDES* (L.) B.S.P.] CLEARCUT TRACTS ON THE DARE COUNTY PENINSULA, NORTH CAROLINA

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February 2000

This report may be cited as:

Van Druten, Brian M. and T.R. Eagle, Jr. 2000. Comprehensive survey of 3,000 acres of Atlantic white cedar [*Chamaecyparis thyoides* (L.) B.S.P.] clearcut tracts on the Dare County peninsula, North Carolina. United States Air Force. Seymour Johnson Air Force Base, North Carolina. 173 pp.

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ACRONYMS

ARNWR	Alligator River National Wildlife Refuge
AWC	Atlantic white cedar (*Chamaecyparis thyoides* (L.) B.S.P.)
DCBR	Dare County Bombing Range
DGPS	Differential Global Positioning System
FGSA	Five Gators Study Area
GIS	Geographic Information System
GPS	Global Positioning System
USFWS	US Fish and Wildlife Service
WestVaCo	West Virginia Pulp and Paper Company
WGS	World Grid System

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ACKNOWLEDGMENTS

I would like to thank the Department of Defense Legacy Resource Management Program for providing the funding for this endeavor. Next, without the Cedar Crew this project would never had been completed. Over the course of three summers the Cedar Crew put forth a tremendous effort to accomplish the task of surveying these cutover tracts. Also the interns that assisted at Alligator River between 1995 and 1997 played a significant role in the completion of this project. There were many obstacles that were encountered but the Cedar Crew worked around them to collect the wealth of data that was generated by this project. I especially want to thank the crew that I worked with during 1997, Patrick Haltigan, Jan Tripp, John Houchins, and Kristi Larson . Together we surveyed 23 of the 45 stands. Thanks again. Tom Eagle played a vital role in this project. He brought the project from its infancy to the completion of the field work. His guidance allowed me to learn what it would take to complete this project and gave me the challenge of doing it. Other members of the Alligator River staff that I would like to recognize for their assistance in the completion of this project are Tom Crews, Bob Noffsinger, Bruce Creef, Glen Stratton, Buddy Jones, and Alan Emery. They have all had a direct influence in the completion of this paper at one point or another. Another integral part of this project was Kelly Davis who actually employed the Cedar Crew. Finally I want to thank the members of the Atlantic white cedar Steering Committee, namely Scott Smith, Emmett Carawan, Bob Belcher, D.A. Brown, and K.O. Summerville for the assistance they have provided me with along the way. This has definitely been a team effort and at this point I want to thank everyone that has been associated with this project.

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Abstract – The purpose of this study was to perform extensive regeneration surveys on 3,000 acres of land held by the U.S. Air Force Dare County Bombing Range and Alligator River National Wildlife Refuge on the Dare County Peninsula. In 1992, a cooperative project was initiated by the Alligator River National Wildlife Refuge, U.S. Air Force Dare County Range, North Carolina State University, and North Carolina Division of Forest Resources to oversee the restoration of Atlantic white cedar (*Chamaecyparis thyoides* (L.) B.S.P.) in clearcut tracts that were at one time mature cedar stands. The status of natural regeneration occurring in the 3,000 acres of clearcut tracts identified for this project was evaluated from 1995 to 1997. Results show that there is tremendous variability within and between stands in relation to stocking levels of Atlantic white cedar seedlings and the amount of competition. There is an abundance of stands (35 stands, or 78%) that have adequate levels of natural regeneration, but there is severe growth inhibition in 34 of these 35 stands. A key inhibitor of the natural regeneration of Atlantic white cedar stands seems to be the high level of shrub competition that exists in these clearcut tracts. Chemical release of Atlantic white cedar from particularly high levels of shrub competition through the application of Arsenal® may allow it to grow freely in stands with adequate natural regeneration levels. This must be incorporated with modifications of the hydrologic regime, that has been altered by the construction of roads, in order for the Atlantic white cedar to regenerate in pure stands.

INTRODUCTION

Atlantic white cedar *(Chamaecyparis thyoides* (L.) B.S.P.) is among the most commercially valuable species in the eastern United States. The natural range extends through the coastal plain of the eastern United States from southern Maine to northen Florida and west through the panhandle of Mississippi. The largest stands are in southern New Jersey, eastern North Carolina, the western end of the Florida Panhandle, and in Alabama around Mobile Bay (Korstian and Brush 1931; Little 1950). Atlantic white cedar is an evergreen conifer that is confined to fresh water swamps, wet depressions, stream banks, and bogs throughout its range. In a mature stand, diameter at breast height (4.5 feet) averages 10 to 14 inches and tree heights average 80 to 85 feet (Korstian and Brush 1931). The commercial value of the species is enhanced by its tendency to grow in pure, dense, even-aged stands.

Atlantic white cedar, also known as "juniper" in eastern North Carolina, has been used for various purposes throughout the past 200 years in North Carolina such as waterfowl decoys, shingles, boat construction, fence posts, cabin logs, planking, molding, and mulch (Little 1951; Brown and Atkinson 1999; Van Druten Personal Observation). Since settlers first arrived in modern-day Dare County, logging of Atlantic white cedar has occurred on some level between intense commercial harvest and low-intensity for personal use. Pinchot and Ashe in 1897 stated that there were large quantities of mature Atlantic white cedar present because of the inaccessibility of the stands which would allow Atlantic white cedar to flourish for many years in Dare County (Little 1950).

The history of Atlantic white cedar commercial logging on the Dare Peninsula dates to the early 1800's when Richmond Cedar Works began logging operations on the western shore of the Dare Peninsula (see Figure 1). After the end of the Civil War, Buffalo Timber Company resumed the logging operations until the late 1800's when they sold the land to Dare Lumber Company. Boom towns, such as Buffalo City and Daresville, sprung up on mainland Dare County to support the commercial logging industry (Brown and Atkinson 1999). With the use of steam engines, boats, oxen,

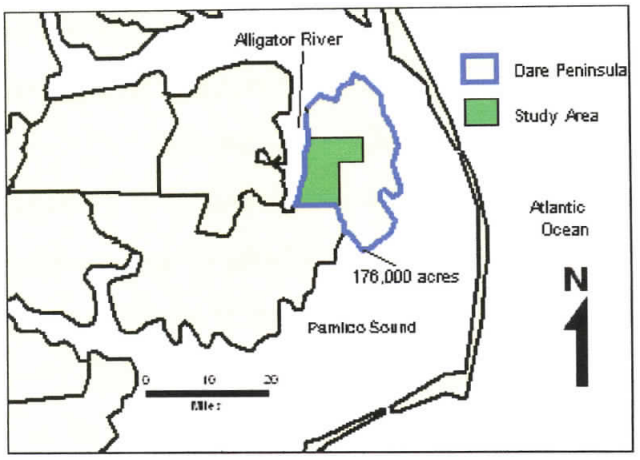


Figure 1: Study Area

and rail lines, Dare Lumber Company made the remote Atlantic white cedar stands of the Dare Peninsula more accessible towards the end of the 19th century. By the end of World War I (1919) all accessible cedar had been removed from the Dare Peninsula (McMullen 1982). Dare Lumber Company held the property until 1952 when Metropolitan Life took control of the property. That same year Metropolitan Life sold the property to West Virginia Pulp and Paper Company, (WestVaCo). In 1964, WestVaCo sold 46,000 acres to the U.S. Air Force and in 1974 they sold the remainder of their property to First Colony Farms. Prior to 1981, First Colony Farms sold all timber rights to Atlantic Forest Products who then subcontracted the logging operations through Alligator Timber Company. Alligator Timber Company logged the area until 1989 when they suspended their logging activities because profits were dwindling (Brown 1999).

Now the Dare Peninsula (approximately 176,000 acres) is dominated by two federal entities. In 1964, the US Air Force took the 46,000 acres that WestVaCo sold them and converted it into a practice range for aerial bombing and strafing. Of this 46,000, only 5,000 acres is used as impact areas for the bombing and strafing, and the remaining 41,000 acres is swamp forest, pocosins, and fresh and saltwater marshes managed under ecosystem management principles for multiple-use and maximum sustained yield (Smith 1997). The Range is totally surrounded by the other major federal land holding; Alligator River National Wildlife Refuge. In 1984, Prudential Life Insurance donated the lion's share of the land that would become Alligator River National Wildlife Refuge to the US Fish and Wildlife Service through the Nature

Conservancy (Creef 1999). Although the US Government controlled the lands, it was not until 1989 that private industrial logging ceased on the Federal lands because Atlantic Forest Products retained the timber rights through all the transfers of ownership.

In 1992, initial funding was provided for the restoration of 3,000 acres of Atlantic white cedar ecosystem by the U.S. Department of Defense Legacy Resource Management Program. Two years later, the U.S. Fish and Wildlife Service adopted an ecosystem approach to management (Bryant 1997). Of the more than 50 ecosystems identified by the USFWS for management was the Atlantic white cedar ecosystem, whose biotic community has been identified as critically endangered (Bryant 1997). This increased the awareness of the U.S. Fish and Wildlife Service on the importance of restoring the Atlantic white cedar ecosystem. In order to achieve the goal of restoring 3,000 acres of Atlantic white cedar, a steering committee was formed by representatives from the U.S. Air Force, Alligator River National Wildlife Refuge, North Carolina Division of Forest Resources, and North Carolina State University and the following tasks were identified: inventory remnant and cutover stands, promote and enhance natural regeneration, develop seed and seedling sources, develop artificial regeneration methods, restore previously high-graded stands, implement a Geographic Information System, and establish water control and management to restore a more natural hydrologic regime (Smith 1997).

Logging operations on the Dare Peninsula left a lasting impression on the landscape. The less destructive logging practices of the late 1800's and early 1900's had relatively little impact on the Atlantic white cedar regeneration compared to the methods used in the 1970's. Means of access to logging areas changed greatly between 1900 and 1970 from using oxen and railways to access stands to creating canals and roads to garner the access of even the most remote stands. The construction of permanent roads led to the unnatural impounding of water on the peninsula and thus altered the hydrology of portions of mainland Dare County. Altered hydrology can negatively impact Atlantic white cedar growth. Korstian and Brush (1931) stated that the growth of Atlantic white cedar on continuously flooded cranberry bogs was slower than that on the edge of upland sites. Impounding of water has proven to be a major limitation to development of Atlantic white cedar seedlings in North Carolina (Kellison 1993).

Another limitation identified by Kellison (1993) was severe competition between Atlantic

white cedar and hardwood species. The competitors' shade interferes both with germination of Atlantic white cedar seeds and the seedling growth. Little (1950) found that as you changed light intensity from full light to heavy shade, Atlantic white cedar height was reduced 28 percent, while hardwood height was reduced by 10 percent or less. He also found that when light intensity was reduced to less than 16 percent of full sunlight, germination was greatly reduced. In mature stands of Atlantic white cedar, where the canopy cover is greater than 60 percent, virtually no Atlantic white cedar seedlings were observed to exceed heights of 5 feet because of shading.

METHODS

Stand Inventory

The goal of this project was to quantify stocking in 3,000 acres of cutover Atlantic white cedar tracts located on the Dare Peninsula. A total of 3,456.33 acres were selected for the study based on U.S. Department of Defense classification (US DOD, undated). The breakdown of the acreage was 1,538.60 acres of stands solely on Alligator River National Wildlife Refuge, 922.06 acres of stands solely on the Dare County Range, and 995.67 acres of stands that are bisected by the boundary between the two which will be referred to as "Joint" lands in this paper.

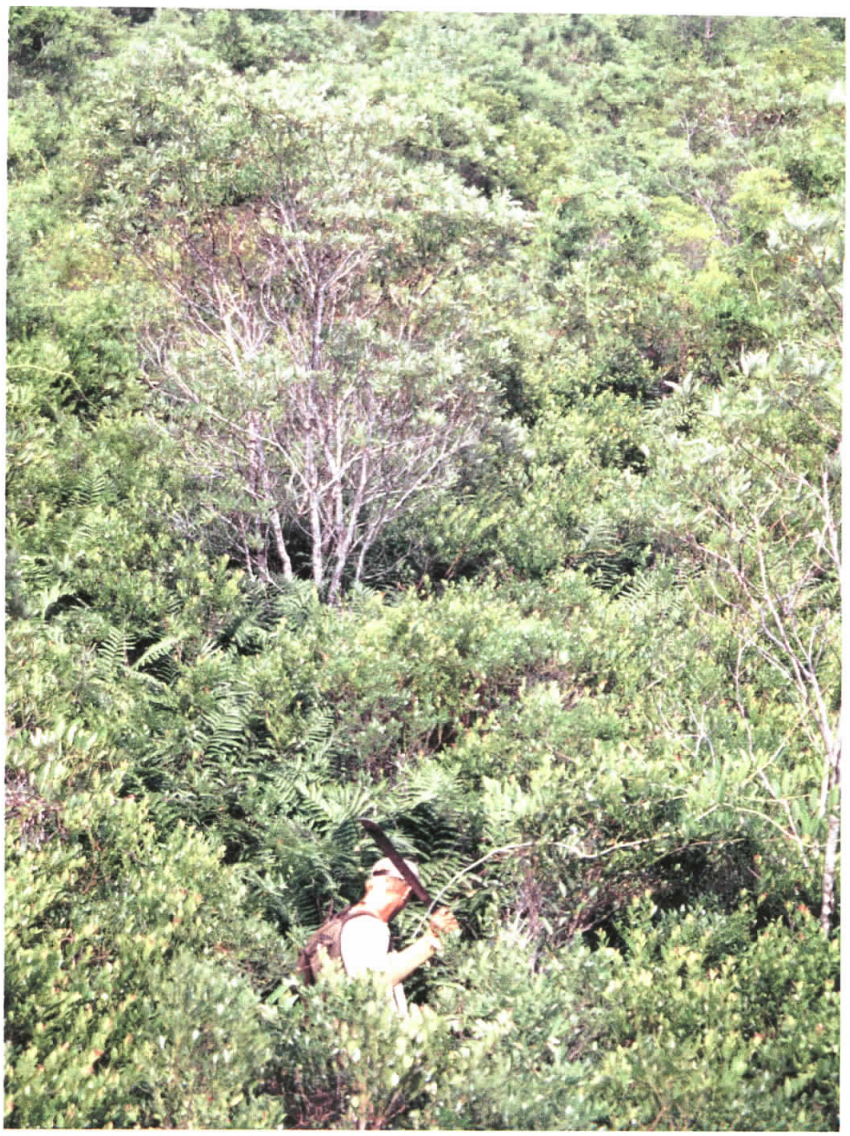


Figure 2: Transect Construction. Note the dense vegetation.

Data collection, for the first year and half, was determined from the guidelines set by the Atlantic

white cedar Steering Committee. Sampling was conducted along evenly spaced transects from 1/1000th acre plots. The transects and corresponding plots were placed 104 feet apart along transects spaced 104 feet apart, creating 4 plots per acre yielding a 0.4% cruise (USFWS, 1994). After using these procedures during the 1995 field season, there were revisions that needed to be made so the project could be finished in a timely manner. Primarily the number of plots per stand

Figure 3: Data Collection. This is standard procedure for collecting data at a plot. The GPS antennae is located in the center of the plot.

that were outlined in the original Statement of Work/Specifications were too high for the field conditions. The sampling specifications were modified to 1/500th acre plots spaced 104 feet apart along transects that are spaced 208 feet apart, giving a coverage of only 2 plots per acre but coverage remained at 0.4% (Eagle 1996).

To determine where the transects would be located for each stand, a baseline was constructed along the road that bordered each stand. The starting point for measuring the

transects was the border between the cutover and the adjoining stand. All measurements were taken with a hip chain which allowed for making reasonable measurements over long distances through extremely dense vegetation. Transects were spaced 208 feet apart (104 feet originally) and were cut perpendicular to the baseline to prevent the transects from intersecting. Transects were constructed by a field technician with a machete, compass, and a hip chain (see Figure 1). Each transect was cut until the back border of the cutover tract was reached, which was delineated by a change to a mature forest. Along the transect, plots were located every 104 feet and marked with survey tape. While cutting the transect, care was taken not to damage the area within the plot to allow accurate data collection. Plots in remnant hardwood pockets were eliminated from the survey because they had not been subjected to the conditions found throughout the clearcut tract and thus would not yield data relevant to this project.

At each plot, numerous parameters were sampled. Plot sizes and boundaries were constantly measured at each 1/500th acre plot by repeatedly extending a string 5.27 feet in length from the center of the plot (r = 5.27' for 1/500th acre plot) (see Figure 2). Once the boundary was determined the data collection was initiated by recording the number of Atlantic white cedar seedlings in the following height classes: < 1', 1'-3', 3'-5', 5'-7', > 7'. Then the four other commercially important species, Pond Pine (*Pinus serotina*), Loblolly Pine (*Pinus taeda*), Bald Cypress (*Taxodium distichum*), and Black Gum (*Nyssa aquatica*), were sampled using the same height classes as the Atlantic white cedar. In addition to identification and classification of the commercially important tree species the three most dominant plant competitors were also listed in descending order of abundance. Dominance was estimated by visually by determining the percent of the plot covered by each of the three dominant species (USFWS 1994). A set of ranges was used to quantify the ocular inspections (in Appendix B). To prevent variability in the ocular estimates, new field technicians went through a training period with a crew member who was experienced at making the estimates. A new field technician was not allowed to collect data alone until the numbers that they collected at a plot matched the numbers that an experienced technician collected at the same plot. Also to prevent the possibility of having 40-plus competitor species during the analysis phase, a list of the 15 most common competitors was used when determining the three most dominant plant competitors. If one of the three competitor species was not on the

list, "other" was used as the default. Observations were recorded about the conditions of the plot itself or the surrounding area to get a better idea about the actual conditions within the stand. These comments were not factored into the recommendations about each stand's regeneration potential primarily because of the variability of the comments due to the number of people collecting the data and no defaults to select from. The comments did provide some insight to the factors influencing our stands, such as deer browse and the presence of logging slash, that could be studied at a later time.

Peat depth was to be measured with a 6 foot piece of rebar (marked with 1" increments) by sticking it into the peat until it struck the underlying mineral soil. Depth was calculated up to 51 inches and when it was deeper, it was just listed as greater than 51 inches. Due to the difficulties associated with carrying this large length of rebar through the cutovers, a set of 4 threaded rods that were 18 inches long and 1/4 inch in diameter were taken in the field and assembled when needed. After a short period, the collection of this information was abandoned all together. Due to the amount of buried slash, dense root mat, or unconsolidation of soil material, it was impossible to ever reach mineral soil. Therefore, the depth of peat or organic material was assumed to be > 51 inches in highly disturbed areas and depth of peat for other areas was determined based on the soil type and the characteristics stated in the Dare County Soil Survey. Average water depth on the plot was also collected in inches from the substrate to the top of the water.

Finally, a Trimble ™ Pro-XL Global Positioning System (GPS) unit/Corvallis Microtechnologies MC IV Data logger was used to collect geographical data in latitude and longitude, in the World Grid System 84 geodetic datum, and store all the data collected at each plot. The Trimble™ unit was later brought into the office and all the information was downloaded onto a computer and post-processed using downloaded from a Trimble™ Base Station base files. The corrected GPS and attribute data was then imported into MapInfo Professional™ to create Geographic Information System (GIS) maps of all the plots and stands.

Data Analysis

At the end of each day, the Trimble ™ units were brought in from the field and the data was downloaded to a computer using Pathfinder ™ Software. These files were then corrected with base files to produce Differential GPS points which allowed for the 3-5 meter accuracy specified by the by the Atlantic white cedar Steering Committee (USFWS 1994). The reason that the files have to be corrected lies in the fact that there are inherent errors in satellite orbits. These inherent errors lead to inaccuracies in the points collected. To rectify this, base files were obtained from a DGPS base station, which consists of a DGPS receiver located at a known position that records data from the same satellites at the same time as the data logger (Trimble™ 1996). The DGPS base station knows its precise location and is able to calculate the difference between its known location and where the satellites are telling the base station it is located. This difference is the satellite error which was used to correct the raw GPS data collected in the field and produce a corrected DGPS file. The corrected file was then exported to Microsoft™ Excel which provided a format for the raw data to be manipulated to produce data that could be used to quantify the amount of regeneration and the amount of competition present within each stand. Some of the statistics that were produced are listed in Appendix C. For calculation purposes, the midpoints of the ranges for competitors were used in configuring the statistics related to competition. All of the numbers and statistics derived were used for statistical summaries from each stand, including means, ranges, and an estimate of variability (USFWS 1994).

Once these Microsoft™ Excel files were completed they were imported into MapInfo Professional™ in two layers. The first layer contained the raw data including: GPS locations, height class data, trees per plot and acre data, competitor data, and the comments. This layer showed the actual location of each plot and transect within a stand on a scale of 1" equals 1,000 feet. The accuracy of the GPS data was verified by placing the stand data over 1996 Dare County Orthophotographs with the same projection of WGS 84. The second layer of data contained all the stand wide summaries of the data. Stand based statistics included in this layer consist of the mean number of trees per acre by height class, greater than 5 feet tall, and all trees for the five commercially important species (Appendix A), the average percent cover by species in each

percent class, and average percent cover by species for all percent classes and levels. This segment was included in the digitized GIS map of the stand boundary. Digitizing of the stand boundaries was performed over the 1996 Dare County black and white Orthophotograph layer with the same WGS 84 projection. Within MapInfo Professional™, GIS maps were produced including a thematic map depicting the density of cedars greater than 5 feet in each stand. These maps provide a visual perspective of the distribution of Atlantic white cedar within the stand boundaries and assist in the management of Atlantic white cedar and other critical plant species.

Stand Classification

With management recommendations having to be made about each stand, a classification system had to be devised that would allow for grouping of stands that contained similar characteristics. Atlantic white cedar management was not a cut and dry issue when the Steering Committee began to create its guidelines for this project. With the goal of regenerating the clearcut tracts back to mature Atlantic white cedar, a target number of seedlings per acre had to be determined in order to set a standard for management recommendations. After talking with Bob Noffsinger (1999), Area Biologist and past Atlantic white cedar Steering Committee member, a figure of 800 Atlantic white cedars greater than 5 feet per acre had been determined by the committee to be adequate stocking to initiate restoration efforts in attempt to produce a mature stand of pure (greater than 50%) Atlantic white cedar. The Committee was comprised of foresters and biologists from the US Air Force, US Fish and Wildlife Service, North Carolina State University, and North Carolina Division of Forest Resources experienced with Atlantic white cedar research and biology. Among the committee, this number (800 AWC > 5 feet per acre) has since been thought to be a bit high so some minor modifications have been made. The new number for adequate stocking level is now thought to be greater than 500 AWC, greater than 5 feet per acre. Using the original number of 800 seedlings per acre and incorporating the new number of 500 seedlings per acre, a system of categories was developed; less than 500, 500 to 800, and greater than 800. Trees per acre and confidence interval were analyzed to determine the stocking category for each stand (Table 2). There is a high level of variability due to patchy growth within an Atlantic white cedar stand that could skew the trees per acre value, so confidence interval had to be looked at in conjunction with the number of cedars greater than 5 feet per acre. The confidence interval was calculated for 80% confidence. Once this number was derived for a stand, the interval was looked at to determine where the low-end number fell in relation to the 3 categories. For example, a stand that had a stocking level of 950 cedars greater than 5 feet per acre but had a confidence interval of 600 to 1,300 would be placed in the 500 to 800 range because of the chance that the true number of cedars greater than 5 feet per acre could fall in the 500 to 800 range. New classifications, for management purposes, have been created

that factor in both the stocking level, confidence interval, and the competition cover. Based on stocking levels, which had the confidence interval factored in, and competition cover each stand was put into one of five levels (See Table 1).

Table 1

Level	Criteria
1	Stocking levels > 800 AWC > 5' per acre and competitor cover > 50 %.
2	Stocking levels > 800 AWC > 5' per acre and competitor cover 50% - 30% or Stocking levels 500 - 800 AWC > 5' per acre and competitor cover > 50 %.
3	Stocking levels 500 - 800 AWC > 5' per acre and competitor cover 50% - 30%.
4	Stocking levels < 500 AWC > 5' per acre.
5	Stocking levels > 800 AWC > 5' per acre and competitor cover < 30 %.

Table 1: Classifications for Management Recommendations

RESULTS

Based on the digitized Atlantic white cedar stands data, it was determined that 3,456.33 acres of clearcut tracts were studied during the three field seasons of this project. The acreage included: 922.06 acres on the Dare County Bombing Range, 1,538.60 acres on Alligator River National Wildlife Refuge, and 995.67 acres on lands that are held jointly by the aforementioned parties. The variability between each stand can be seen in Table 2. Although Atlantic white cedar stem density variability is high between the stands almost every stand contains a dense layer of shrubs. The mean shrub cover for all the stands is 57.75% (24.03 % - 84.35%).

Table 2

STAND ID #	ACRES	MEAN # OF AWC > 5' PER ACRE	CONFIDENCE INTERVAL (80%)	PERCENT COMPETITION COVERAGE	LOCATION	MANAGEMENT LEVEL
5	148.12	2506.41	2208.73 - 2804.09	56.76	ARNWR	1
5a	151.23	3063.11	2765.35 - 3360.87	44.30	ARNWR	2
7	230.06	2667.07	2443.51 - 2890.63	54.62	ARNWR	1
7a	141.31	2825.00	2440.21 - 3209.79	52.19	ARNWR	1
7b	190.73	3129.21	2800.65 - 3457.77	47.87	ARNWR	2
15	66.55	1098.00	937.78 - 1258.22	73.88	DCBR	1
16	75.18	2456.25	1949.39 - 2963.11	65.72	Joint	1
17	16.14	1080.00	768.85 - 1391.15	84.35	DCBR	2
18	175.80	3531.80	2982.12 - 4081.48	42.93	Joint	2
19	5.41	470.59	198.78 - 742.40	81.76	DCBR	4
24	181.00	897.23	792.93 - 1001.53	30.36	DCBR	3
27	34.61	3413.79	2685.78 - 4141.80	63.10	ARNWR	1
28	19.38	3083.33	2070.14 - 4096.52	70.31	ARNWR	1
29	86.63	5299.07	4661.11 - 5937.03	59.60	ARNWR	1
69	5.38	0	0	54.25	Joint	4
72a	77.60	2135.51	1841.54 - 2429.48	60.47	DCBR	1
73a	62.98	2108.25	1700.62 - 2552.88	57.16	ARNWR	1
74a	23.79	1000.00	713.44 - 1286.56	39.84	ARNWR	3

STAND ID #	ACRES	MEAN # OF AWC > 5' PER ACRE	CONFIDENCE INTERVAL (80%)	PERCENT COMPETITION COVERAGE	LOCATION	MANAGEMENT LEVEL
75	10.86	90.91	-25.59 - 207.41	44.77	ARNWR	4
76	3.41	500.00	94.74 - 905.26	31.50	ARNWR	4
77	10.09	2916.67	592.05 - 5241.29	42.50	ARNWR	3
78	7.76	1500.00	434.76 - 2565.24	46.36	ARNWR	3
79	172.70	2481.91	2209.43 - 2754.39	61.10	ARNWR	1
79a	77.02	1336.13	1147.24 - 1525.02	61.41	ARNWR	1
79b	3.91	583.33	198.27 - 968.39	82.92	ARNWR	4
80	25.10	340.91	186.66 - 495.16	53.98	Joint	4
81	19.26	1523.81	1112.62 - 1935.00	71.19	DCBR	1
82	44.59	320.90	233.96 - 407.84	72.05	DCBR	4
83	79.21	938.36	781.31 - 1095.41	68.46	DCBR	2
84	3.59	200.00	-56.31 - 456.31	34.00	DCBR	4
85	4.74	2000.00	408.78 - 3591.22	52.50	DCBR	4
86	29.57	1216.22	623.88 - 1808.56	68.51	Joint	2
87	15.96	846.15	506.56 - 1185.74	72.12	Joint	2
88	17.18	500.00	213.96 - 786.04	64.79	Joint	4
89	42.81	2531.25	2005.49 - 3057.01	72.34	DCBR	1
90	14.46	1055.56	785.53 - 1325.59	64.81	DCBR	2
91	134.40	1549.02	1383.30 - 1714.74	55.47	Joint	1
92	94.28	1227.64	1058.26 - 1397.02	24.02	DCBR	5
93	185.40	1150.58	997.44 - 1303.72	55.47	DCBR	1
94	261.40	1614.29	1367.60 - 1860.98	39.24	Joint	2
95	255.70	2326.97	2131.28 - 2522.66	71.62	Joint	1
96	98.28	3949.10	3372.04 - 4526.16	53.58	ARNWR	1
97	51.38	2200.00	1867.60 - 2532.40	63.73	ARNWR	1
98	87.02	1503.55	1288.71 - 1718.39	58.14	DCBR	1
99	14.35	2055.56	1339.83 - 2771.29	70.56	ARNWR	1

Table 2: Summary of results from stand inventory.

Figure 4

Stand Breakdown by Number

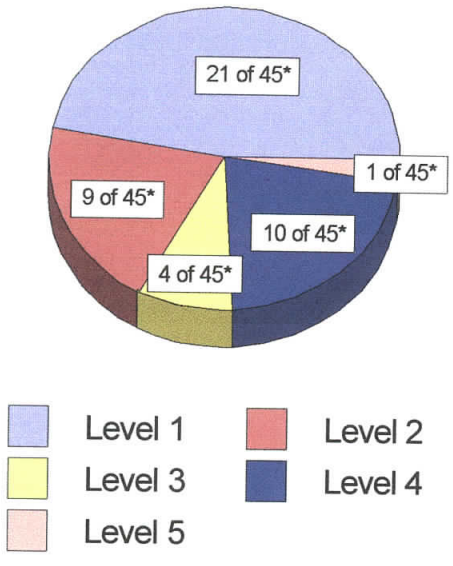
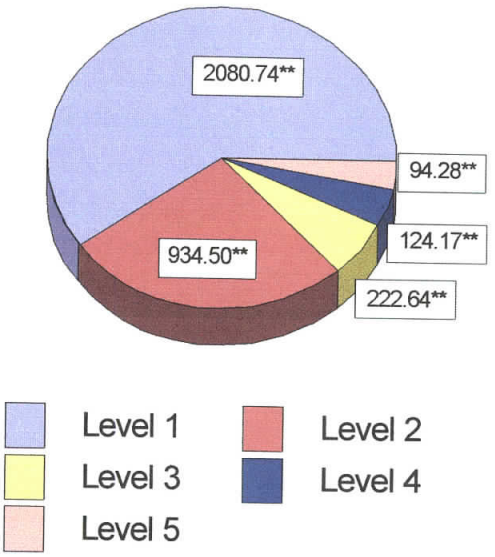


Figure 5

Stand Breakdown by Acerage



Level 1 stands made up the highest percentage of all stands surveyed by both number (47%) and acreage (60%) (Figure 4 and 5). The Level 4 stands were second in percentage by number (22%) but were fourth in percentage by acreage (4%). Third in percentage by number were Level 2 stands (20%), which were second in percentage by acre (27%). Level 3 stands were fourth in percentage by number (9%) and third in percentage by acre (6%). Finally, Level 5 stands were last in both (2% by number and 3% by acre).

The leading five species that covered the stands (based on mean % cover for all stands), in order, are; Fetter Bush (*Lyonia lucida*), Common Wax Myrtle (*Myrica cerifera*), Other (species not identified), Bitter Gallberry (*Ilex glabra*), and Laurel Greenbrier (*Smilax laurifolia*) (see Appendix D). Mean percent cover of these five species totaled 36.00 % of every stand and make up 62.23% of all competitors.

In addition to the amount of Atlantic white cedar, there has recently been an emphasis on determining the amount of key soft mast species within these cutover tracts because of their value to certain wildlife species. The two key species are Black Gum (*Nyssa aquatica*) and Blueberry

(*Vaccinium spp.*). Overall, Black Gum averaged 556.82 stems per acre (all trees from 0' to >7') (CI = 389.89 to 723.75) and Blueberry comprised 1.66 % of all competitor cover in all 45 stands surveyed. In the Level 1 and 2 stands (see Management Recommendations for significance of Level 1 and 2 stands), Black Gum stocking averaged 604.06 stems per acre (CI = 472.47 to 735.65). These same trees only made up 2.34 % of the competitors' cover in Level 1 and 2 stands, somewhat below the average of 5,528.54 stems per acre (CI = 4,688.07 to 6,369.01) for Atlantic white cedar in these same Level 1 and 2 stands. This is nine times higher than for Black Gum. Blueberry was only 1.86% of the competitor cover in the Level 1 and 2 stands.

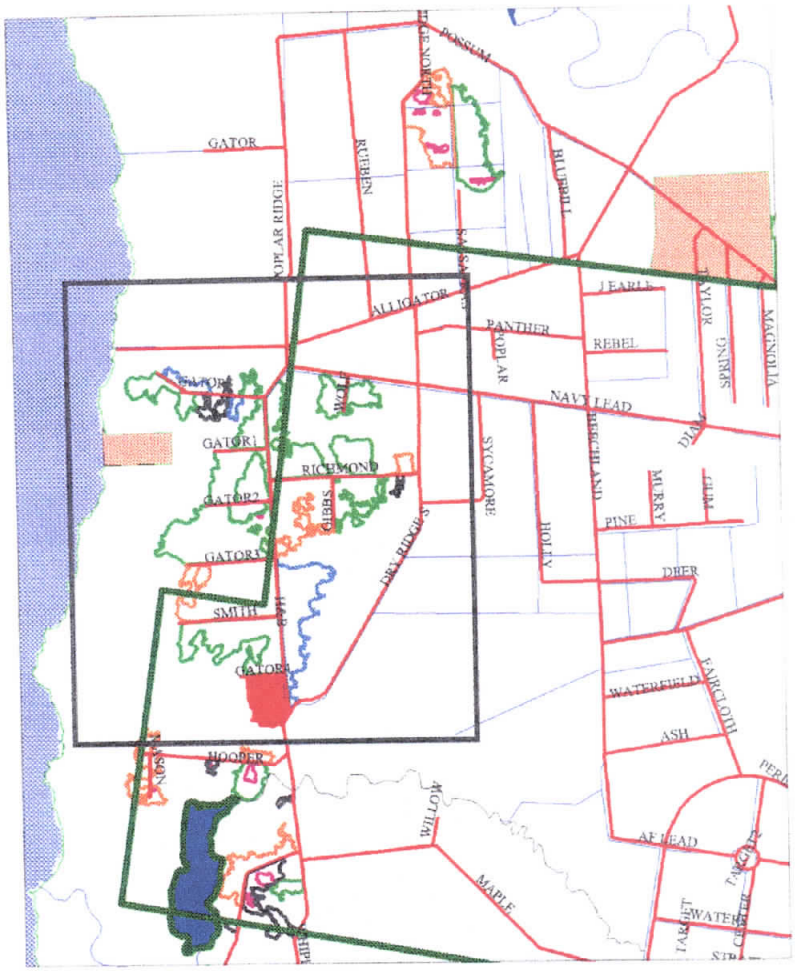


Figure 6: Five Gators Study Area is within the black box.

Competitors may also be having an effect on the age ratio present within the stands. Looking at the 21 stands located within the Five Gators Study Area (FGSA is a subset of the clearcut tracts that was used here solely because the age of each stand was known.) (see Figure 6) there are some trends that show the effect the competitors are having on the maturation of the cedar stands (Table 3).

Table 3

Mean #of AWC >5ft.	Ratio of AWC >5' vs. <5'	Mean stand age	Mean % cover
1437.74	4.10 : 1	16.3	34.79
1557.15	0.74 : 1	18.5	42.80
1720.69	0.66 : 1	17.3	65.85

Table 3: Trends Related to Age-class and Competition in Five-Gators Study Area. (Green (n=3) = stands with more cedars >5' than <5' and cover <50%, Yellow (n=2) = stands with more cedars <5' than >5' and cover <50%, and White (n=10) = stands with cover >50%) FGSA was used because each stand's age was known. Also the high and low figure for each color was thrown out in the calculations.

As the competitor cover increases, the ratio of cedars greater than 5 feet to cedar less than 5 feet decreases; however, the average number of cedars greater than 5 feet increases. Korstian and Brush (1931) state that even-aged Atlantic white cedar stands are the result of crown closure at an early age (10-15 years) which has the effect of shading younger Atlantic white cedar and shrubs, creating a monoculture. The only stands in the FGSA where this is beginning to take place are those stands where the ratio of Atlantic white cedar greater than 5 feet to Atlantic white cedar less than 5 feet is greater than one to one (Stands 24, 74a, 76, 77, and 92). In the remaining stands, as the competition cover increases, the Atlantic white cedar has a more uneven height class structure. It appears that as the older cedars die-off due to shading or some of the shrubs lose their leaves, new seedlings are sprouting up from the seed bank that is present in the soil or from nearby trees that are producing seeds. With growth rates for Atlantic white cedar after the first year approaching 0.3 m/yr., some taller Atlantic white cedars will survive but the shrub layer is eventually outcompeting the young cedars in many stands. Atlantic white cedar may survive 1 to 3 years in light intensity averages of 4% to 6% of full sunlight, but shading from shrubs may kill them (Ladermann 1989). Little and Garrett (1990) found that at a light intensity of 77% of full sunlight, initial growth of seedlings was double that at 16% of full light, and almost quadruple that at 2% full light. In the current study, we see the new seedlings that sprouted in full sunlight and had their growth inhibited. Not all of the regenerating cedars are going to be killed by the competitors, but survival may not be adequate to achieve canopy closure. The trees that are

greater than 5 feet tall are considered free to grow unless they are overtopped by *Smilax* spp. This is the primary reason that the data for Atlantic white cedar greater than 5 feet is emphasized. Without some type of silvicultural treatment, the stands on the Dare peninsula may either contain a low density of Atlantic white cedar (similar to their current state), mixed hardwood stands, or a dense conglomeration of shrubs typical of a High Pocosin. In the cases where the shrub layer typical of a High Pocosin is present, hydrology is a problem and will have to be altered in an attempt to revert it to the conditions that were present before the large scale logging took place.

MANAGEMENT RECOMMENDATIONS

Nearly all (44 of 45) of the clearcut tracts surveyed require silvicultural treatment in order to produce mature Atlantic white cedar stands. The USFWS and the DOD can hopefully secure the funding necessary to carry out the management objectives set forth in this document. Resources should also be secured to maintain a forestry staff at Alligator River to continue Atlantic white cedar research and management. Not only is mature Atlantic white cedar itself considered an endangered ecosystem by The Nature Conservancy, it is also home to the Hessel's hairstreak butterfly (*Mitoura hesseli*) which has been reviewed by the US Fish and Wildlife Service for endangered species listing and is classified as a species of special concern by the State of North Carolina (Laderman 1989). Hessel's hairstreak has been located on the Dare Peninsula (Beck and Garnett 1983). The larva of the Hessel's hairstreak feeds exclusively on Atlantic white cedar so preserving Atlantic white cedar would provide habitat for this species. Tall, mature Atlantic white cedar also provides habitat for the Black-throated Green Warbler (*Dendroica virens*), which is a forest interior dwelling species that is a species of concern in the South Atlantic Coastal Plain, as well as many other neotropical migrants.

Under the classifications, only one Level 5 stand exists (Stand 92). This would be the only stand that could be left in its current state that would become a mature Atlantic white cedar stand without silvicultural treatment due to adequate stocking and low competition. This stand should be monitored carefully and studied in the future to determine conditions that have allowed this stand to regenerate to its current status so it can be duplicated elsewhere in the future. In addition Stand 92 should be used as a reference to compare the growth and other variables to other sites where active management will be practiced.

Fire has been suggested as a tool to clear the competition. Low intensity fire during high water tends to eliminate competitors and favors Atlantic white cedar germination (Laderman 1989). Burning was tested on Alligator River National Wildlife Refuge during the summer of 1996 in Stand 91 in order to prepare it for planting (see Appendix F). A prescribed burn was attempted on a hot, dry day while the stand was experiencing relatively high water. The fire was not successful in meeting the objective of reducing the competing species, but it should be noted

that this was during the infancy of prescribed burning at Alligator River National Wildlife Refuge outside of farm fields. (Crews 1999). In the future some experimenting with fire should take place in the Level 4 stands that contain the highest stocking levels (of Level 4 stands) in order to find out how effective fire could be at assisting Atlantic White Cedar regeneration (see Appendix F for Level 4 stands). By using the best, in terms of stocking levels, Level 4 stands, there will be some cedars present but at the same time it reduces the potential for ruining a highly stocked stand if the fire was to burn at a higher intensity than anticipated. This should be coupled with planting or seeding if the fire is effective at removing the competitors, especially if seedling mortality is high due to fire.

Figure 7: Terraveh at work in an Atlantic white cedar stand.

A drum-chopper has been experimented with to eliminate the competitors in order to prepare a site for planting. There were many logistical problems that were associated with this method. As with most Atlantic white cedar clearcut tracts located on the Dare Peninsula, the one that the experiment was conducted in contained soft, hydric muck soils that made movement of machinery difficult. A terreveh, a flexible tracked tractor designed specifically for use in unconsolidated material (such as snow), was used to pull the drum-chopper (see Figure 7). It faced extreme difficulties operating in the highly disturbed organic muck soils that are associated with the Atlantic white cedar cutover tracts and skid trails (see Figure 8). Although it could be explored again, chopping with heavy equipment seems to have many problems associated with it because of the past soil disturbances caused during logging.

Figure 8: The drum chopper bogged down in the muck soil.

The most successful treatment may be the use of the chemical Arsenal® to release the cedar seedlings from the shrub competition. Arsenal®, a member of the Imidazolinone family, is a surfactant free aqueous solution to be mixed in water and generally applied as a post-emergent spray for control of most annual and perennial grasses, broadleaf weeds, vines, hardwood brush and trees for forestry site preparation and for release of conifers from woody and herbaceous competition. It is readily absorbed through the foliage and roots and translocated quickly throughout the plant, with accumulation occurring in the meristematic regions. In perennials, the herbicide is translocated into the roots and thus prevents most respouting (American Cyanamid Company 1994). Arsenal® is approved for the release of Atlantic white cedar because of the testing that was performed by American Cyanamid Company in conjunction with the North Carolina Division of Forest Resources on the Dare County Range in August 1995. Six-year old Atlantic white cedar trees were released with 8, 16, and 24 oz of product per acre on two 50 foot wide swaths and a fourth spot was used as a control (Quickie et all 1998). Five permanent fixed-radius plots were created within each swath for data collection. The results from this experiment

were as follows; Black Gum (*Nyssa aquatica*) mortality increased from 81% to 100% as the Arsenal® rate increased. Red Maple (*Acer rubrum*) mortality was greater than 95% for all rates. Mortality of Fetter Bush (*Lyonia lucida*), Red Bay (*Persea barbonia*), and Sweet Pepper Bush (*Clethra alnifolia*) increased with rate, but was less than 60% at the highest rate. Wax Myrtle (*Myrica cerifera*) mortality was less than 15% for any rate. *Smilax* spp. were controlled at an average of 67% for all rates. However, Atlantic white cedar had no mortality. (Quickie et all 1998). Arsenal® is also approved for use in forest watersheds, which is relevant to its use here on the Dare Peninsula. A study performed by the U.S. Forest Service in 1985 found that leaching did not occur after Arsenal® was used and there was no significant off-site movement via stream sediment from the test sites (American Cyanamid 1988). Arsenal® only appeared in 1% of the samples taken below 30 cm so there is a very low probability of ground water contamination. The calculated half-life of Arsenal® is 19 to 34 days for soil, 12 to 40 days for plant tissue, and 37 to 44 days in forest litter (American Cyanamid 1988).

Although Arsenal® application would be effective in Level 1, 2, and 3 stands, release of the Level 1 stands should be top priority, with Level 2 stands running a close second, because they consist of the greatest stocking and the greatest percentage of competitor coverage and therefore are in the greatest danger of being stunted or killed from competition (see Appendix E or F for stand placements). As funding becomes available, time should be invested in releasing all Level 1 and 2 stands because of their high stocking levels and competitor coverage. The acreage of the Level 1 and 2 stands totals 3015.24, which exceeds the 3,000 acre goal originally established by the Atlantic white cedar Steering Committee as the target restoration acreage (USFWS 1994). When funding permits, Level 3 stands (222.64 acres) should also be considered for release because they also contain adequate stocking levels for the establishment of a mature Atlantic white cedar stand.

Arsenal® would be effective in reducing the shrub competition for approximately 2 years, but hydrologic restoration does need to occur in order to return it to a more natural pattern, i.e. pre-commercial logging. Both flooding and drought can have negative effects on the natural regeneration of Atlantic white cedar (Korstian and Brush 1931, Little 1950, Laderman 1989, Kellison 1993). Without hydrologic restoration, the spraying will not support long term Atlantic

white cedar restoration. Currently, there are plans to insert water control structures in 10 areas that have been identified as critical to restoring a more natural hydrologic regime. Hydrologic restoration coupled with Arsenal® application should allow for the restoration of mature Atlantic white cedar stands.

Certain important shrubs and overstory hardwoods that produce soft mast, such as Black Gum (*Nyssa aquatica*) and Blueberry (*Vaccinium spp.*) occur in the clearcut tracts that were surveyed. They provide an important seasonal food source to some animals. Biologists are concerned that, with the application of Arsenal® some Black Gum will be lost within these stands. In order to maximize the benefits of Arsenal®'s intended use and minimize the loss of food sources for wildlife, the remnant hardwood pockets would not be treated with Arsenal® and would be allowed to remain within the Atlantic white cedar stands. Also, the thematic maps of the stands indicate the areas within each stand that contain required stocking levels for release. Black Gum and Blueberry are usually predominant anywhere Atlantic white cedar is absent. Those areas should be avoided during Arsenal® application in order to preserve them for wildlife. The Dare Peninsula currently contains only 5,976 acres of mature Atlantic white cedar stands, which is 56.5 % of what remains in the state of North Carolina (10,583 acres) (Davis and Daniels 1998). In 1894, Ashe estimated that there were 199,922 acres of Atlantic white cedar forest in North Carolina, almost 19 times the current level (Ladermann 1989). Since the Atlantic white cedar biotic community is identified as critically endangered, restoring the 3,015.24 acres of clearcut tracts would significantly increase Atlantic white cedar acreage. Blueberry and Black Gum may be eliminated if Arsenal® is applied in the clearcut tracts. However these species occur frequently throughout the study area and Blueberry is a frequent understory component of mature Atlantic white cedar stands(Van Druten Personal Observation). Since the effects of Arsenal® are not long term, there no reason to believe that Blueberry should not establish itself as an understory component in the stands that have been proposed for chemical release.

Permanent plots marked by either metal or Polyvinyl-chloride pipe are located in stands 7, 7b, 17, 19, 24, 28, 79, 79a, 94, 95, and 99 (see Appendix F for location). A summary of the data for these eleven stands can be found in Appendix G. The hard copy of this data set will be located at Alligator River National Wildlife Refuge for future reference. Among these, there are six Level

1 stands (7, 28, 79, 79a, 95, and 99) that should be the priority for release. If any of these stands are released, the permanent plots should be remeasured one year after release and then on a five year cycle to monitor the changes. Also, a system should be devised for post-Arsenal® monitoring in the remaining stands that do not contain permanent plots.

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Atlantic White Cedar Inventory Form

CRUISERS NAMES:	DATE:

STAND #:	PLOT #:	LAT: LONG:
SOIL TYPE:	PEAT DEPTH:	WATER DEPTH:

SPECIES	AGE	<1'	1-3'	3-5'	5-7'	>7'	TOTAL
White Cedar							
Cypress	XXX						
Black Gum	XXX						
Loblolly Pine	XXX						
Pond Pine	XXX						

DOMINANT PLANT COMPETITORS

	NAME & DESCRIPTION	PERCENT COVER
SPECIES-1-		
SPECIES-2-		
SPECIES-3-		

SUMMARY/COMMENTS:

DATA COLLECTED AT EACH PLOT

Plot ID
Cruisers
Comments
Date
White Cedar < 1
White Cedar 1-3
White Cedar 3-5
White Cedar 5-7
White Cedar > 7
Cypress < 1
Cypress 1-3
Cypress 3-5
Cypress 5-7
Cypress > 7
Black Gum < 1
Black Gum 1-3
Black Gum 3-5
Black Gum 5-7
Black Gum > 7
Pond Pine < 1
Pond Pine 1-3
Pond Pine 3-5
Pond Pine 5-7
Pond Pine > 7
Loblolly Pine < 1
Loblolly Pine 1-3
Loblolly Pine 3-5
Loblolly Pine 5-7
Loblolly Pine > 7
Primary Comp
- Fetter Bush
- Bitter Gallberry
- Sweet Gallberry
- Black Gum
- Red Maple
- Wax Myrtle
- Red Bay
- Sweet Pepper Bush
- Blueberry
- Smilax laurifolia
- Smilax walteri
- Smilax rotundifolia
- Wool Grass
- Broom Sedge
- Cattail
- Other

Percent Cover Primary
- **1-5**
- **6-25**
- **26-50**
- **51-75**
- **76-95**
- **96-100**

Secondary Comp
- Fetter Bush
- Bitter Gallberry
- Sweet Gallberry
- Black Gum
- Red Maple
- Wax Myrtle
- Red Bay
- Sweet Pepper Bush
- Blueberry
- Smilax laurifolia
- Smilax walteri
- Smilax rotundifolia
- Wool Grass
- Broom Sedge
- Cattail
- Other

Percent Cover Secondary
- **1-5**
- **6-25**
- **26-50**
- **51-75**
- **76-95**
- **96-100**

Tertiary Comp
- Fetter Bush
- Bitter Gallberry
- Sweet Gallberry
- Black Gum
- Red Maple
- Wax Myrtle
- Red Bay
- Sweet Pepper Bush
- Blueberry
- Smilax laurifolia
- Smilax walteri
- Smilax rotundifolia
- Wool Grass
- Broom Sedge
- Cattail
- Other

Percent Cover Tertiary
- **1-5**
- **6-25**
- **26-50**
- **51-75**
- **76-95**
- **96-100**

Soil Type
- Pungo Muck
- Belhaven
- Ponzer
- Roper
- Hyde

Peat Depth
Water Depth

Competition evaluation systems are in bold text.

Calculated Statistics

Average (mean) - The sum of all the individual observations or items of a sample and divided by the number of items in the sample.

Standard deviation - A measure of the dispersion of a frequency distribution that is the square root of the arithmetic mean of the squares of the deviation of each of the class frequencies from the arithmetic mean of the frequency of distribution.

Standard error - The standard deviation of the probability function or probability density function of a random variable and especially of a statistic.

Confidence interval - a group of continuous or discrete adjacent values that is used to estimate a statistical parameter and that tends to include the true value of the parameter a predetermined proportion of the time if the process of finding the group of values is repeated a number of times.

This table shows the stand-wide statistics for the plant competitors. Appendix H lists the scientific names for the 15 plant species used in this table. The chart that follows this table shows the number of times that each plant species showed up as one of the top five competitors on a stand-wide basis. Note that except for Bamboo Brier, the top five competitors overall (based on the mean percent cover) were also the species that most frequently appeared in the top five.

	Bitter Gallberry	Wool Grass	Red Maple	Fetter Bush	Wax Myrtle	Sweet Pepper Bush	Bamboo Brier	Blueberry	Black Gum	Red Bay	Gallberry	Broom Sedge	Green Brier	Brown Leaf Brier	Cattail	Other	Total % Cover
5	7.14	5.05	4.18	4.08	3.07	1.38	1.29	0.89	0.84	0.73	0.49	0.06	0.01	0.00	0.00	27.55	**56.76**
5a	5.89	4.31	4.26	12.60	1.30	2.26	3.99	2.43	0.18	2.38	0.66	0.00	0.53	0.01	0.32	3.19	**44.31**
7	6.45	0.00	3.29	12.99	5.09	3.92	1.95	0.80	0.34	8.10	2.49	0.00	4.55	0.00	0.00	4.65	**54.62**
7a	4.85	0.46	0.13	16.79	8.51	0.90	8.03	1.19	2.09	1.42	1.36	0.00	5.14	0.00	0.01	1.31	**52.19**
7b	5.13	0.46	1.08	18.65	3.62	3.60	0.76	2.11	1.04	5.95	1.04	0.00	0.23	0.00	0.00	4.20	**47.87**
15	1.41	0.08	8.34	22.11	0.93	2.42	11.14	0.00	2.10	3.28	3.16	0.00	4.02	0.00	0.00	14.88	**73.87**
16	10.50	0.00	2.63	20.03	7.66	1.25	2.44	2.88	0.19	15.13	2.66	0.00	0.00	0.00	0.00	0.38	**65.75**
17	5.90	1.85	11.50	21.25	2.40	2.80	4.05	0.00	8.35	4.15	8.30	0.00	1.55	0.00	0.00	12.25	**84.35**
18	1.45	0.33	3.53	10.17	4.46	0.67	5.81	0.28	4.70	1.45	3.86	0.00	1.25	0.10	0.00	4.87	**42.93**
19	0.88	0.00	22.06	14.26	0.00	2.79	3.24	0.00	3.24	7.79	2.21	0.00	10.88	0.00	0.00	14.41	**81.76**
24	1.96	0.01	0.92	4.92	5.75	1.85	1.21	1.13	6.26	0.32	0.68	0.01	2.90	0.00	0.01	2.44	**30.37**
27	9.05	0.00	2.76	19.91	17.50	2.41	1.72	0.69	1.38	5.60	1.03	0.00	0.52	0.00	0.00	0.52	**63.09**
28	11.25	0.69	1.06	24.86	1.25	6.67	2.64	0.00	2.69	6.39	7.78	0.00	0.05	0.00	0.00	7.08	**72.41**
29	10.21	0.00	0.14	21.43	7.76	0.82	5.54	0.68	0.51	7.20	0.58	0.35	2.99	0.00	0.00	1.40	**59.61**
69	9.50	0.00	0.00	12.50	9.00	0.00	3.25	0.00	0.25	7.00	0.00	0.00	12.75	0.00	0.00	0.00	**54.25**
72a	0.72	0.79	4.04	16.61	1.61	0.33	10.61	3.11	13.60	1.38	1.78	0.00	1.78	0.00	0.00	4.11	**60.47**
73a	0.72	0.00	2.22	20.59	5.34	0.21	8.94	2.06	0.18	8.25	5.93	0.00	0.57	0.00	0.00	2.16	**57.17**
74a	0.00	0.00	1.77	11.85	4.11	0.56	1.37	0.97	0.00	7.74	9.19	0.00	0.00	0.00	0.00	2.26	**39.82**
75	0.00	0.23	7.73	5.23	1.59	1.36	5.00	0.00	2.73	3.41	0.00	0.00	3.41	0.00	0.00	14.09	**44.78**
76	0.00	0.00	3.50	13.50	0.00	0.00	0.50	0.50	0.00	7.50	0.00	0.00	3.00	0.00	0.00	3.00	**31.50**
77	0.00	0.00	2.08	11.25	2.50	0.00	2.50	2.50	0.00	5.42	5.00	0.00	8.75	0.00	0.00	2.50	**42.50**
78	1.59	1.36	4.55	14.77	1.36	1.82	0.23	2.73	1.36	1.36	2.73	0.00	0.00	0.00	0.00	12.50	**46.36**
79	7.35	0.56	4.39	14.82	9.45	2.65	7.16	0.50	1.10	5.36	2.64	0.00	0.85	0.00	0.00	4.27	**61.10**
79a	11.03	0.00	4.35	9.52	8.49	2.56	4.79	0.42	2.37	3.57	0.88	0.53	7.33	0.00	0.00	5.57	**61.41**

	Bitter Gallberry	Wool Grass	Red Maple	Fetter Bush	Wax Myrtle	Sweet Pepper Bush	Bamboo Brier	Blueberry	Black Gum	Red Bay	Gallberry	Broom Sedge	Green Brier	Brown Leaf Brier	Cattail	Other	Total % Cover
79b	11.25	0.00	2.50	39.58	2.50	2.50	0.83	0.00	0.00	5.00	12.50	0.00	0.00	0.00	0.00	6.25	**82.91**
80	4.77	19.43	8.41	4.09	3.41	0.80	0.80	0.91	3.98	0.68	0.00	0.00	3.52	0.00	0.00	3.18	**53.98**
81	15.36	0.00	10.60	9.05	3.93	0.00	2.50	1.79	2.14	3.21	0.00	1.55	5.95	0.00	0.00	15.12	**71.20**
82	3.54	0.00	3.10	16.01	20.00	2.05	3.73	1.49	1.60	4.81	1.38	0.00	11.57	0.00	0.56	2.20	**72.04**
83	11.23	1.08	1.80	17.02	15.21	0.87	2.67	0.98	1.42	4.35	0.00	0.00	8.29	0.00	0.00	3.54	**68.46**
84	3.00	0.00	12.00	0.50	0.00	0.50	0.00	7.50	0.50	0.00	0.00	0.50	0.50	0.00	0.50	8.50	**34.00**
85	0.00	0.00	13.75	11.25	16.88	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.63	0.00	0.00	0.00	**52.51**
86	2.77	0.00	4.46	25.34	12.03	1.82	6.62	2.50	0.00	3.85	0.41	0.20	3.85	0.00	0.00	4.66	**68.51**
87	3.94	0.00	5.58	27.88	10.67	2.40	8.56	0.10	3.08	4.33	1.15	0.00	4.04	0.00	0.00	0.38	**72.11**
88	3.23	0.00	2.71	16.04	8.96	1.25	5.10	0.00	0.21	1.56	0.00	0.00	22.81	0.00	0.00	2.92	**64.79**
89	8.54	0.00	1.82	17.55	19.48	2.50	2.14	0.05	1.41	3.13	1.41	0.00	10.57	0.00	0.00	3.75	**72.35**
90	2.31	0.00	2.78	13.33	8.70	2.59	20.74	0.65	1.67	5.19	0.00	0.00	6.20	0.00	0.00	0.65	**64.81**
91	0.29	0.00	2.22	20.46	3.56	0.18	3.56	2.08	3.97	1.41	1.21	0.00	12.35	0.00	0.00	4.18	**55.47**
92	3.31	0.63	0.51	4.17	2.62	0.55	2.26	0.89	2.52	1.95	1.59	0.00	1.59	0.00	0.02	1.42	**24.03**
93	2.38	2.15	2.95	10.76	6.33	1.97	5.14	1.54	5.40	0.17	3.76	0.00	4.46	0.00	0.00	8.45	**55.46**
94	0.64	0.00	3.71	6.19	6.55	2.40	1.19	2.26	7.40	1.17	1.67	0.00	3.86	0.00	0.00	2.19	**39.23**
95	2.02	4.75	5.20	15.60	8.48	2.94	7.43	2.58	4.24	1.62	2.98	0.00	3.61	0.00	0.00	10.18	**71.63**
96	1.21	0.09	2.40	17.75	3.38	1.84	6.03	3.19	2.07	2.66	2.54	0.00	3.97	0.00	0.00	6.44	**53.57**
97	3.50	0.65	2.00	16.30	14.93	1.98	11.25	0.95	2.45	1.45	3.45	0.03	3.20	0.03	0.03	1.55	**63.75**
98	1.08	0.53	9.15	14.13	4.41	1.63	4.45	0.00	5.59	1.84	3.65	0.00	5.43	0.00	0.00	6.24	**58.13**
99	7.78	0.00	0.00	2.08	12.64	0.00	0.00	19.17	0.00	0.83	0.00	0.00	15.00	0.00	0.00	13.06	**70.56**
Overall Mean % Cover	4.56	1.01	4.40	14.66	6.61	1.64	4.51	1.66	2.34	3.78	2.27	0.07	4.54	0.00	0.03	5.65	**57.75**

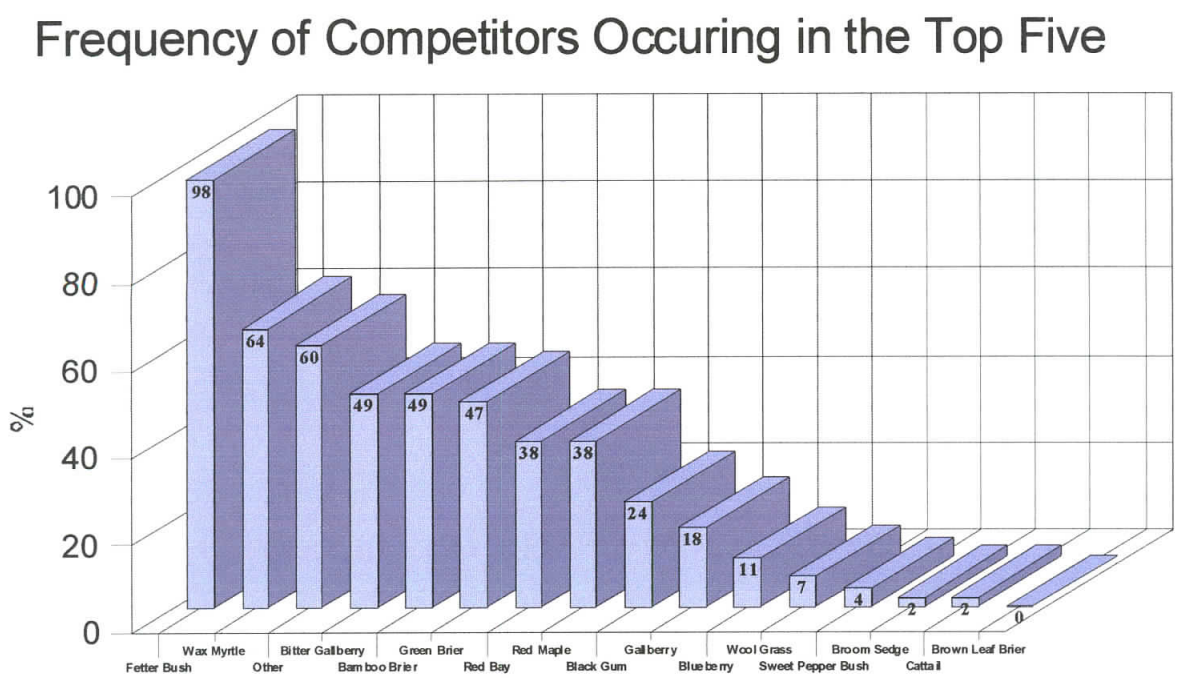
Number 1 Competitor

Number 2 Competitor

Number 3 Competitor

Number 4 Competitor

Number 5 Competitor


Frequency of Competitors Occuring in the Top Five
%
100
80
60
40
20
0
98
64
60
49
49
47
38
38
24
18
11
7
4
2
2
0
Fetter Bush
Wax Myrtle
Other
Bitter Gallberry
Bamboo Brier
Green Brier
Red Bay
Red Maple
Black Gum
Gallberry
Blueberry
Wool Grass
Sweet Pepper Bush
Broom Sedge
Cattail
Brown Leaf Brier

Stand ID # - 5

Location - On USFWS property east of Sassafras Road.

Acreage - 148.12

Average AWC per acre all - 7335.47

Standard Deviation - 8259.19

Standard Error - 539.92

Confidence interval 80% - 6643.53 to 8027.41

Average AWC >5' per acre - 2506.41

Standard Deviation - 3553.24

Standard Error - 232.28

Confidence interval 80% - 2208.73 to 2804.09

Average Black Gum per acre all: 353.38

Confidence interval 80%: 303.65 to 427.11

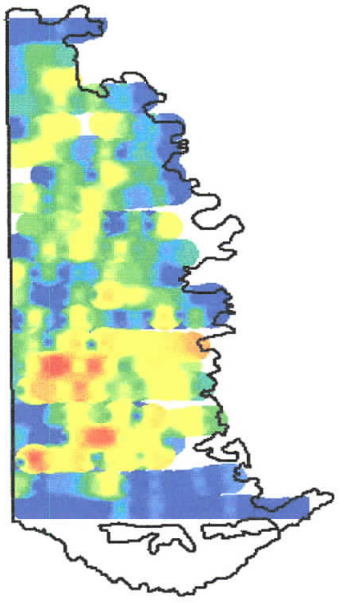
Top five competitors

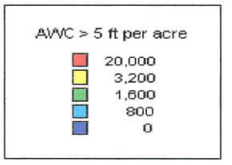
Other ----------27.55%
Bitter Gallberry--------- 7.14%
Wool Grass---------- 5.05%
Red Maple---------- 4.18%
Fetter Bush---------- 4.08%

Total percent cover - 56.76%

Management Recommendation - Level 1

Stand 5
AWC per acre > 5 ft





N
1

Stand ID # - 5a

Location - On USFWS property west of Sassafras Road

Acreage - 151.23

Average AWC per acre all - 7953.88

Standard Deviation - 8636.23

Standard Error - 232.34

Confidence interval 80% - 7182.75 to 8725.01

Average AWC >5' per acre - 3063.11

Standard Deviation - 3334.72

Standard Error - 232.34

Confidence interval 80% - 2765.33 to 3360.87

Average Black Gum per acre all - 116.50

Confidence interval 80% - 75.99 to 157.01

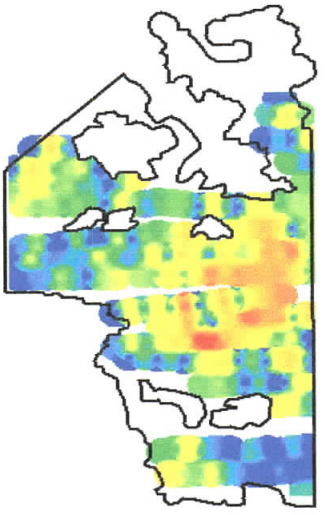
Top five competitors

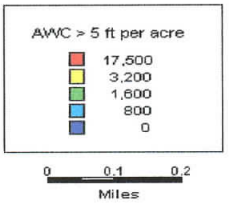
Fetter Bush---------- 12.60%
Bitter Gallberry--------- 5.89%
Wool Grass---------- 4.31%
Red Maple---------- 4.26%
Bamboo Brier---------- 3.99%

Total percent cover - 44.30%

Management Recommendation - Level 2

Stand 5a
AWC per acre > 5 ft





Stand ID # - 7

Location - Located on USFWS property south and west of Pollock Road.

Acreage - 230.06

Average AWC per acre all - 5279.27

Standard Deviation - 7102.60

Standard Error - 350.77

Confidence interval 80% - 4829.74 to 5728.80

Average AWC >5' per acre - 2667.07

Standard Deviation - 3532.18

Standard Error - 174.44

Confidence interval 80% - 2443.51 to 2890.63

Average Black Gum per acre all - 115.85

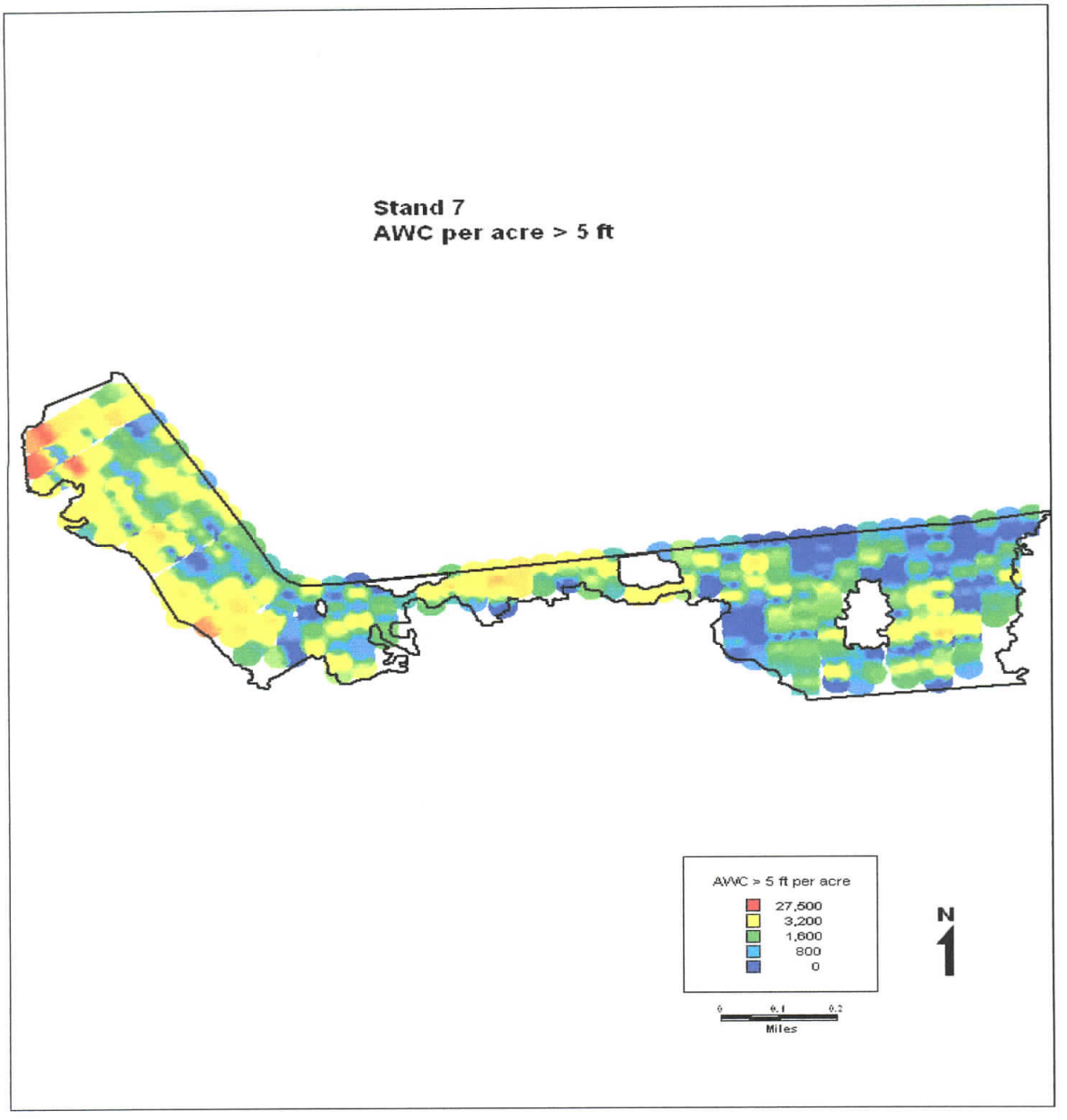
Confidence interval 80% - 89.81 to 141.89

Top five competitors

Fetter Bush----------12.99%
Red Bay---------- 8.10%
Bitter Gallberry--------- 6.45%
Wax Myrtle---------- 5.09%
Other---------- 4.65%

Total percent cover - 54.62%

Management Recommendation - Level 1


Stand 7
AWC per acre > 5 ft
AWC > 5 ft per acre
27,500
3,200
1,600
800
0
N
1
0
0.1
0.2
Miles

Stand ID # - 7a

Location - Located on USFWS property west of North Pollock Road

Acreage - 141.31

Average AWC per acre all - 5577.08

Standard Deviation - 7031.26

Standard Error - 453.87

Confidence interval 80% - 4995.43 to 6158.73

Average AWC >5' per acre - 2825.00

Standard Deviation - 4651.52

Standard Error - 300.25

Confidence interval 80% - 2440.21 to 3209.79

Average Black Gum per acre all - 302.08

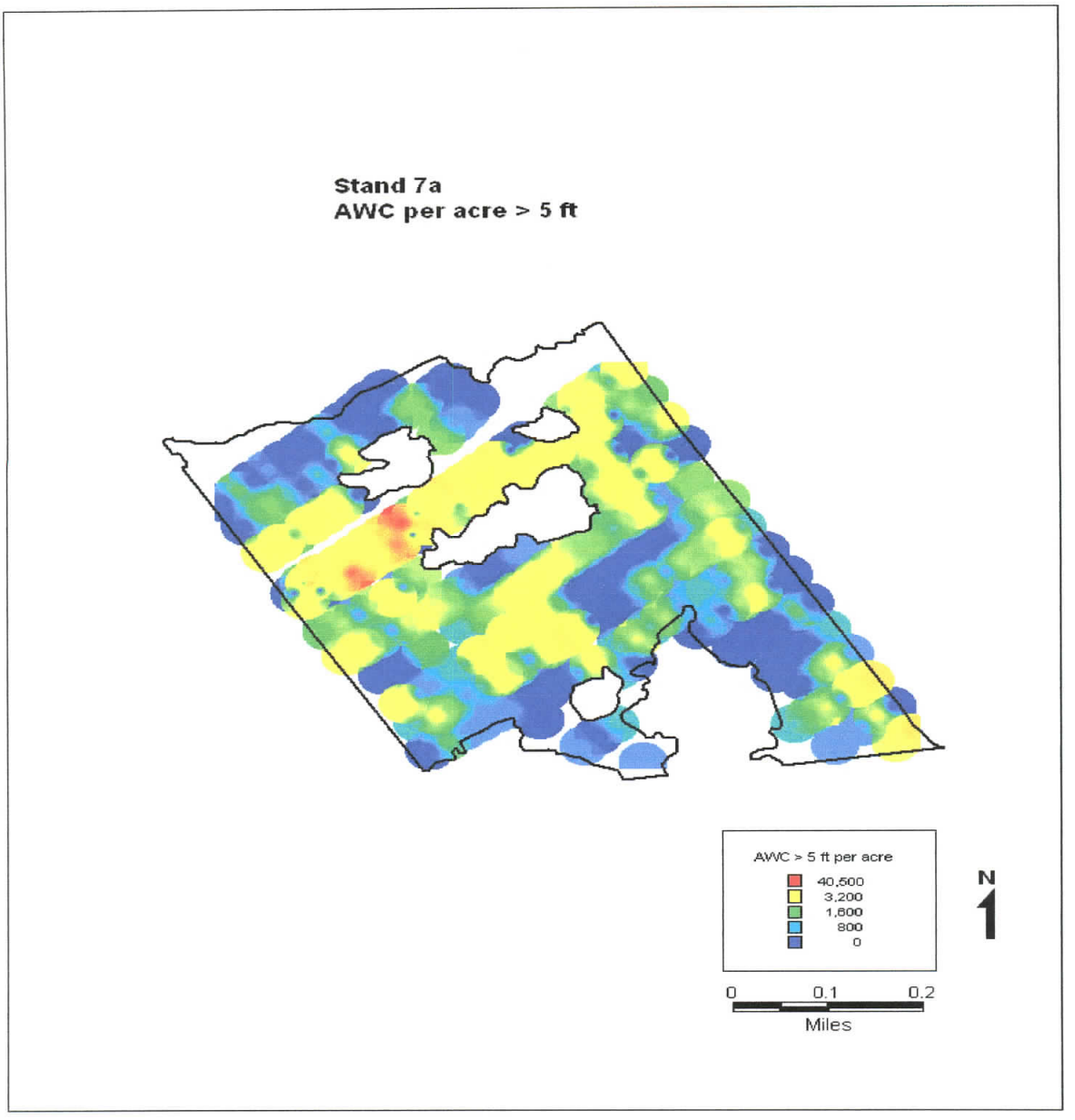
Confidence interval 80% - 239.60 to 364.56

Top five competitors

Fetter Bush----------16.79%
Wax Myrtle---------- 8.51%
Bamboo Brier---------- 8.03%
Green Brier---------- 5.14%
Bitter Gallberry--------- 4.85%

Total percent cover - 52.19%

Management Recommendation - Level 1


Stand 7a
AWC per acre > 5 ft
AWC > 5 ft per acre
40,500
3,200
1,600
800
0
N
1
0
0.1
0.2
Miles

Stand ID # - 7b

Location - On USFWS east of North Pollock Road

Acreage - 190.73

Average AWC per acre all - 4041.20

Standard Deviation - 5447.13

Standard Error - 333.36

Confidence interval 80% - 3613.98 to 4468.42

Average AWC >5' per acre - 3129.21

Standard Deviation - 4189.27

Standard Error - 256.38

Confidence interval 80% - 2800.65 to 3457.77

Average Black Gum per acre all - 170.41

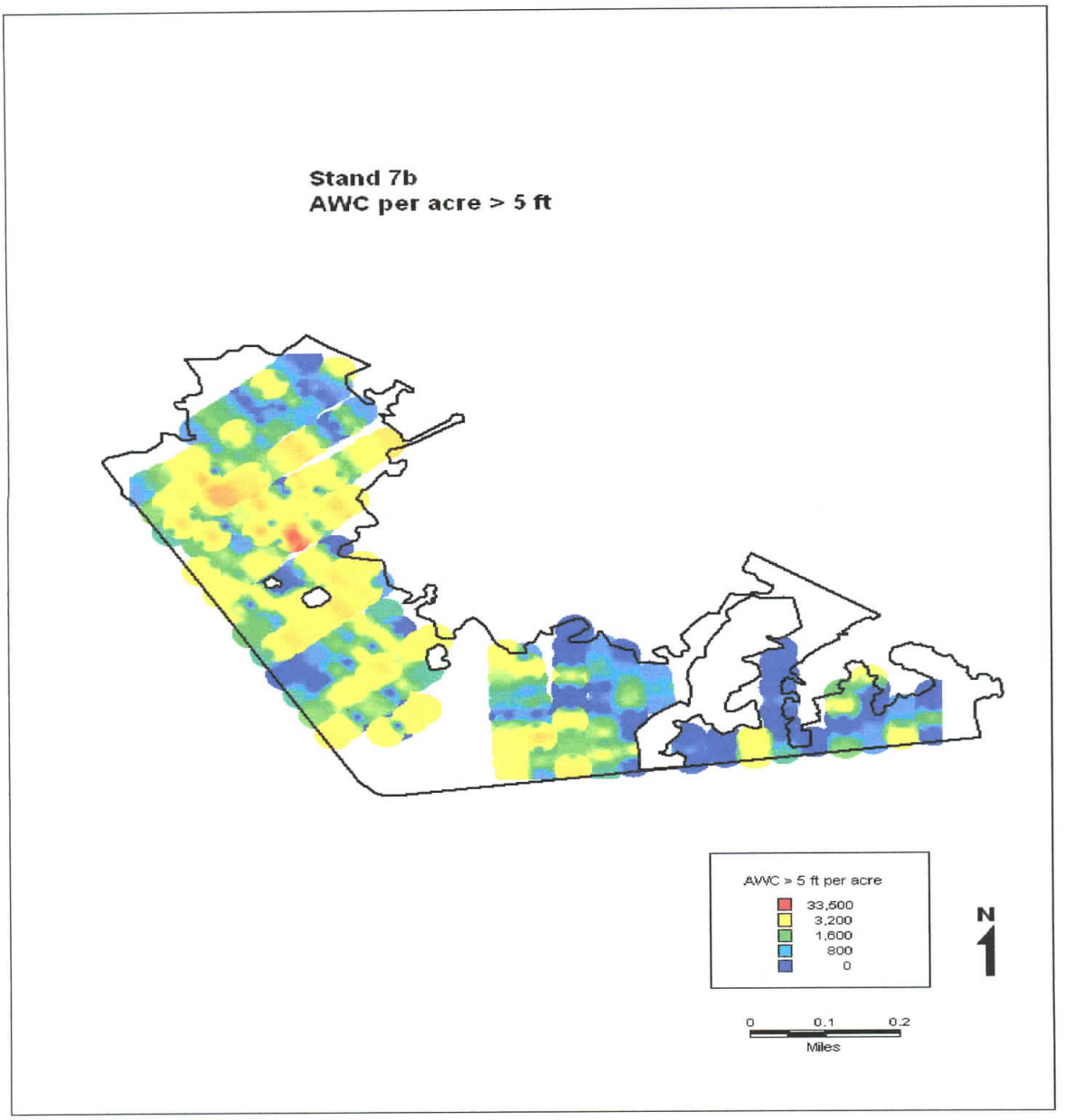
Confidence interval 80% - 133.01 to 207.81

Top five competitors

Fetter Bush----------18.65%
Red Bay---------- 5.95%
Bitter Gallberry--------- 5.13%
Other---------- 4.20%
Wax Myrtle---------- 3.62%

Total percent cover - 47.87%

Management Recommendation - Level 2


Stand 7b
AWC per acre > 5 ft
AWC > 5 ft per acre
33,600
3,200
1,600
800
0
N
0
0.1
0.2
Miles

Stand ID # - 15

Location - On Dare County Range north of Richmond Road

Acreage - 66.55

Average AWC per acre all - 3891.00

Standard Deviation - 6621.11

Standard Error - 413.82

Confidence interval 80% - 3360.67 to 4421.33

Average AWC >5' per acre - 1098

Standard Deviation - 2000.34

Standard Error - 125.02

Confidence interval 80% - 937.78 to 1258.22

Average Black Gum per acre all - 266.00

Confidence interval 80% - 194.72 to 337.28

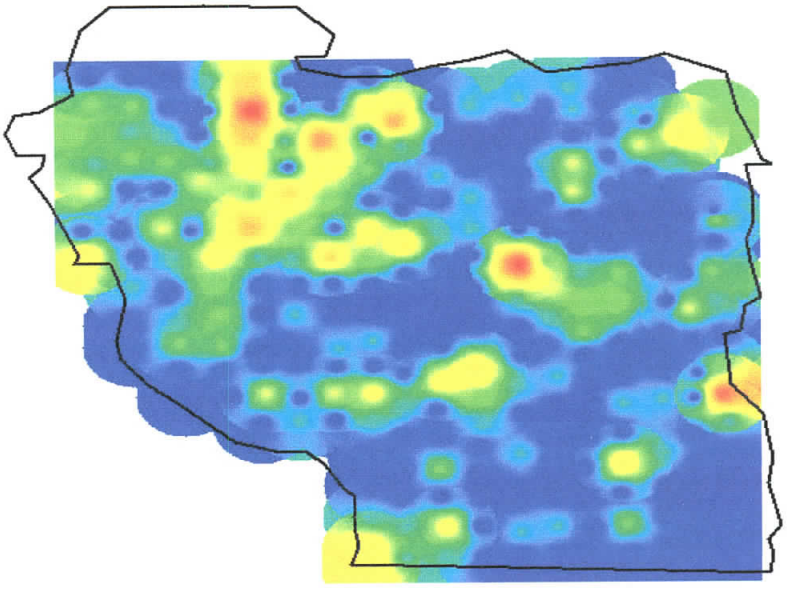
Top five competitors

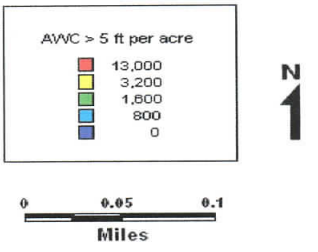
Fetter Bush---------- 22.11%
Other---------- 14.88%
Bamboo Brier---------- 11.14%
Red Maple---------- 8.34%
Green Brier---------- 4.02%

Total percent cover - 73.88%

Management Recommendation - Level 1

Stand 15
AWC per acre > 5 ft





N

1

0 0.05 0.1

Miles

Stand ID # - 16

Location - Jointly owned. Located north of Navy Shell Road.

Acreage - 75.18

Average AWC per acre all - 3856.25

Standard Deviation - 7883.73

Standard Error - 881.43

Confidence interval 80% - 2726.66 to 4985.84

Average AWC >5' per acre - 2456.25

Standard Deviation - 3537.50

Standard Error - 395.50

Confidence interval 80% - 1949.39 to 2963.11

Average Black Gum per acre all - 237.50

Confidence interval 80% - 184.06 to 290.94

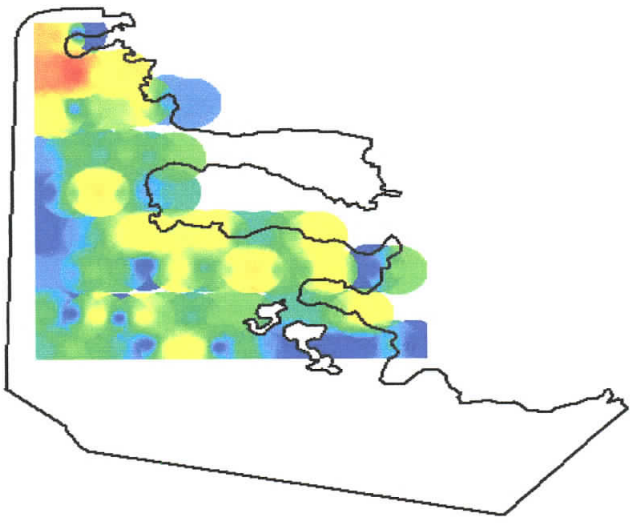
Top five competitors

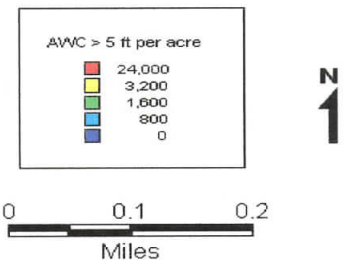
Fetter Bush---------- 20.03%
Red Bay---------- 15.13%
Bitter Gallberry-------- 10.50%
Wax Myrtle---------- 7.66%
Blueberry---------- 2.88%

Total percent cover - 65.72%

Management Recommendation -Level 1

Stand 16
AWC per acre > 5 ft





Stand ID # - 17

Location - Located on the Dare County Range north of Richmond Road

Acreage - 16.14

Average AWC per acre all - 2800.00

Standard Deviation - 2725.54

Standard Error - 385.45

Confidence interval 80% - 2306.21 to 3293.79

Average AWC >5' per acre - 1080.00

Standard Deviation - 1716.78

Standard Error - 242.79

Confidence interval 80% - 768.85 to 1391.15

Average Black Gum per acre all - 1140.00

Confidence interval 80% - 798.45 to 1481.55

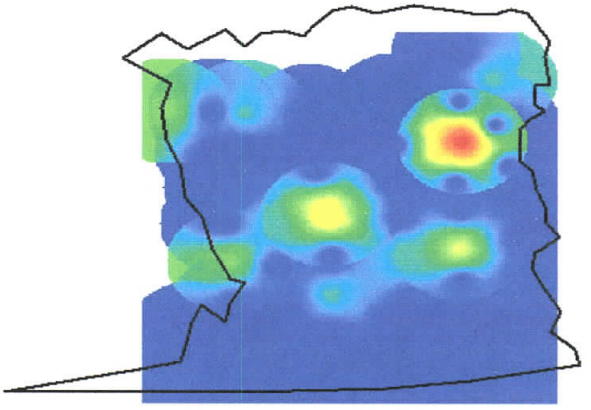
Top five competitors

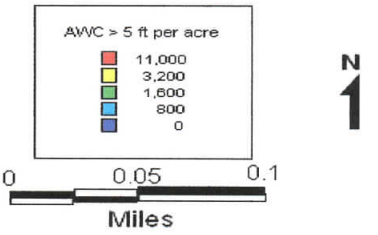
Fetter Bush---------- 21.25%
Other---------- 12.25%
Red Maple---------- 11.50%
Gallberry---------- 8.30%
Bitter Gallberry--------- 5.90%

Total percent cover - 84.35

Management Recommendation - Level 2

Stand 17
AWC per acre > 5 ft





Stand ID # - 18

Location - Jointly owned. Located on the corner of Richmond Road and H&B Road.

Acreage - 175.80

Average AWC per acre all - 7309.40

Standard Deviation - 13378.42

Standard Error - 773.69

Confidence interval 80% - 6317.87 to 8300.93

Average AWC >5' per acre - 3531.80

Standard Deviation - 7416.64

Standard Error - 428.92

Confidence interval 80% - 2982.12 to 4081.48

Average Black Gum per acre all - 1115.40

Confidence interval 80% - 995.32 to 1235.48

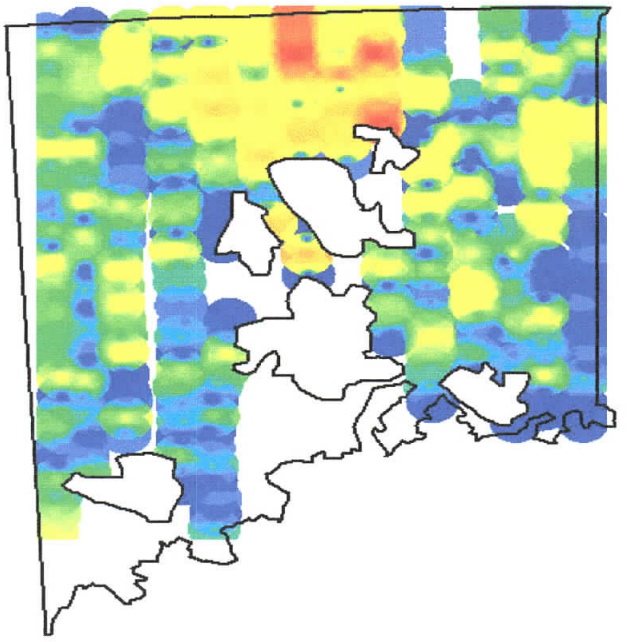
Top five competitors

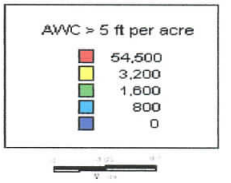
Fetter Bush---------- 10.17%
Bamboo Brier---------- 5.81%
Other---------- 4.87%
Black Gum---------- 4.70%
Wax Myrtle---------- 4.46%

Total percent cover - 42.93%

Management Recommendation - Level 2

Stand 18
AWC per acre > 5 ft





N
1

Stand ID # - 19

Location - On the Dare County Range south of Richmond Road.

Acreage - 5.41

Average AWC per acre all - 4000.00

Standard Deviation - 6557.44

Standard Error - 1590.41

Confidence interval 80% - 1961.81 to 6038.19

Average AWC >5' per acre - 470.59

Standard Deviation - 874.47

Standard Error - 212.09

Confidence interval 80% - 198.78 to 742.40

Average Black Gum per acre all - 765.00

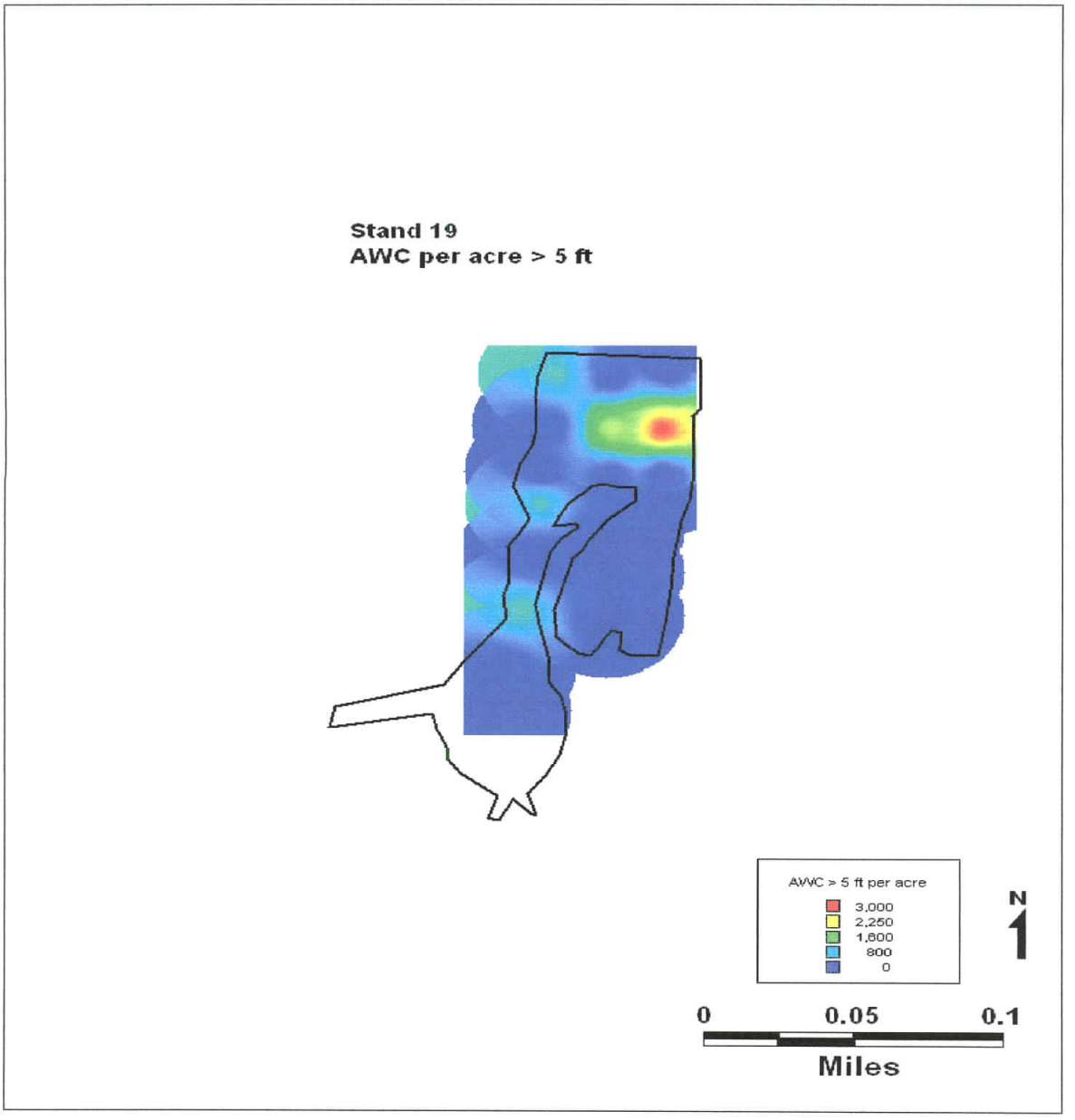
Confidence interval 80% - 346.12 to 1183.88

Top five competitors

Red Maple---------- 22.06%
Other---------- 14.41%
Fetter Bush---------- 14.26%
Green Brier---------- 10.88%
Red Bay---------- 7.79%

Total percent cover - 81.76%

Management Recommendation- Level 4


Stand 19
AWC per acre > 5 ft
AWC > 5 ft per acre
3,000
2,250
1,600
800
0
N
1
0
0.05
0.1
Miles

Stand ID # - 24

Location - Located on Dare County Range east of H&B between Gator 3 and Dry Ridge Road.

Acreage - 181.00

Average AWC per acre all - 1371.54

Standard Deviation - 1844.74

Standard Error - 115.98

Confidence interval 80% - 1225.91 to 1523.17

Average AWC >5' per acre - 897.23

Standard Deviation - 1294.57

Standard Error - 81.39

Confidence interval 80% - 792.93 to 1001.53

Average Black Gum per acre all - 2098.81

Confidence interval 80% - 1890.68 to 2306.94

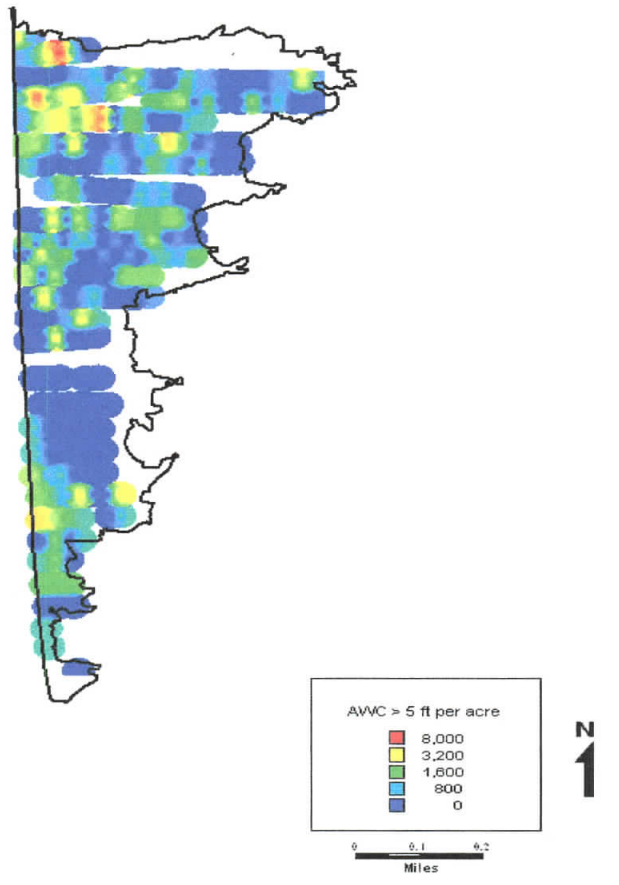
Top five competitors

Black Gum---------- 6.26%
Wax Myrtle---------- 5.75%
Fetter Bush---------- 4.92%
Green Brier---------- 2.90%
Other---------- 2.44%

Total percent cover - 30.36%

Management Recommendation - Level 3

Stand 24
AWC per acre > 5 ft



Stand ID # - 27

Location - Located on USFWS property north of Navy Shell Road.

Acreage - 34.61

Average AWC per acre all - 7362.07

Standard Deviation - 5323.29

Standard Error - 988.51

Confidence interval 80% - 6095.24 to 8628.90

Average AWC >5' per acre - 3413.79

Standard Deviation - 3059.15

Standard Error - 568.07

Confidence interval 80% - 2685.78 to 4141.80

Average Black Gum per acre all - 603.45

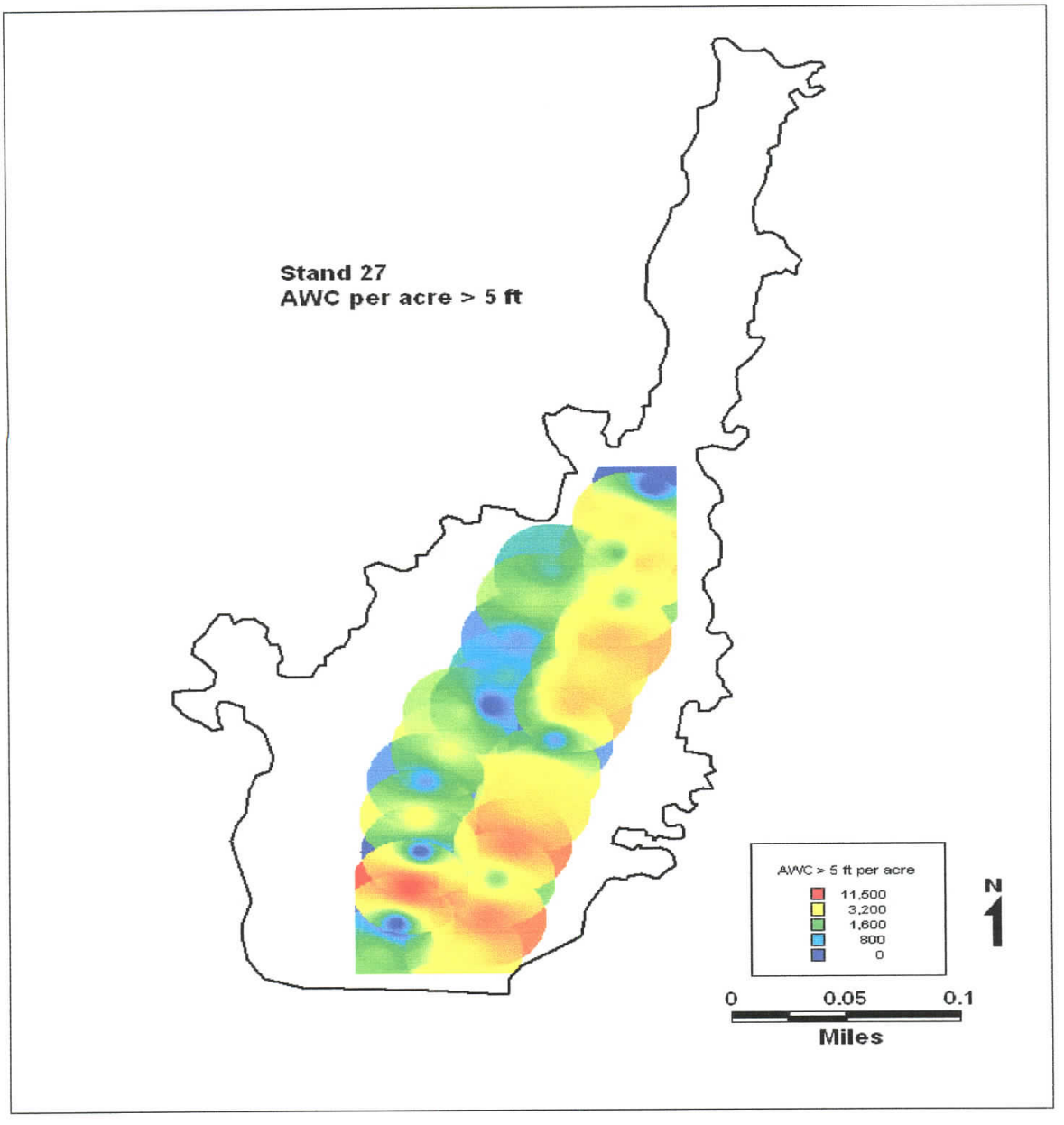
Confidence interval 80% - 342.41 to 864.49

Top five competitors

Fetter Bush---------- 19.91%
Wax Myrtle---------- 17.50%
Black Gum---------- 9.05%
Red Bay---------- 5.60%
Red Maple---------- 2.76%

Total percent cover - 63.10%

Management Recommendation - Level 1


Stand 27
AWC per acre > 5 ft
AWC > 5 ft per acre
11,500
3,200
1,600
800
0
N
0
0.05
0.1
Miles

Stand ID # - 28

Location - Located on USFWS property west of Navy Shell North.

Acreage - 19.38

Average AWC per acre all - 12653.06

Standard Deviation - 18417.10

Standard Error - 2631.01

Confidence interval 80% - 9281.28 to 16024.84

Average AWC >5' per acre - 6510.20

Standard Deviation - 12007.16

Standard Error - 1715.31

Confidence interval 80% - 4311.95 to 8708.45

Average Black Gum per acre all - 367.35

Confidence interval 80% - 219.30 to 515.40

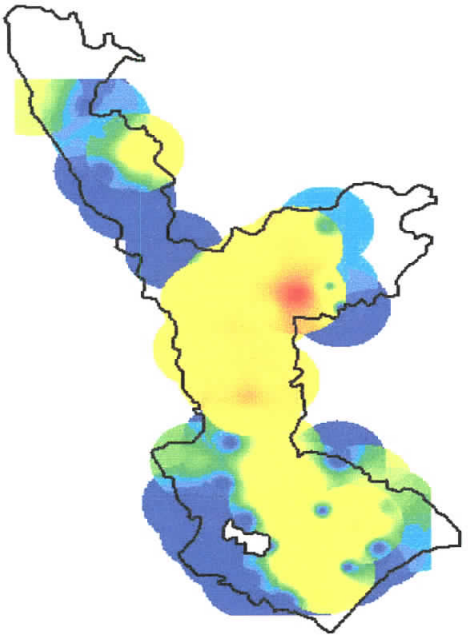
Top five competitors

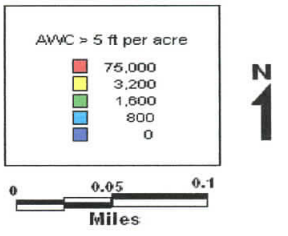
Fetter Bush---------- 25.82%
Gallberry---------- 9.23%
Other---------- 8.11%
Red Bay---------- 6.68%
Bitter Gallberry--------- 6.28%

Total percent cover - 70.31%

Management Recommendation - Level 1

Stand 28
AWC per acre > 5 ft





Stand ID # - 29

Location - Located on USFWS property east of Navy Shell North.

Acreage - 86.63

Average AWC per acre all - 11420.56

Standard Deviation - 10535.02

Standard Error - 1013.73

Confidence interval 80% - 10121.41 to 12719.71

Average AWC >5' per acre - 5299.07

Standard Deviation - 5173.34

Standard Error - 497.81

Confidence interval 80% - 4661.11 to 5937.03

Average Black Gum per acre all - 102.80

Confidence interval 80% - 48.08 to 157.52

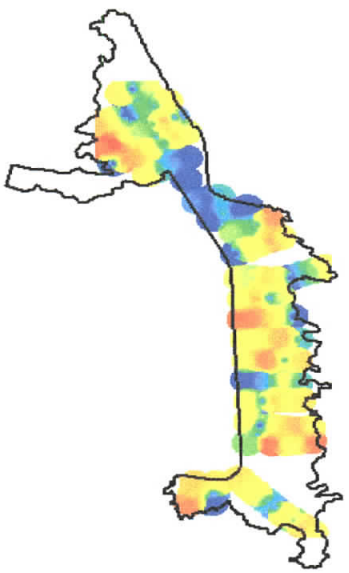
Top five competitors

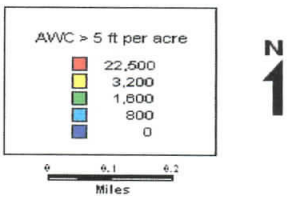
Fetter Bush---------- 21.43%
Bitter Gallberry--------- 10.21%
Wax Myrtle---------- 7.76%
Red Bay---------- 7.20%
Bamboo Brier---------- 5.54%

Total percent cover - 59.60

Management Recommendation - Level 1

Stand 29
AWC per acre > 5 ft





Stand ID # - 69

Location - Jointly owned. Located west of Nichols Road.

Acreage - 5.38

Average AWC per acre all - 1450.00

Standard Deviation - 2443.24

Standard Error - 772.62

Confidence interval 80% - 459.85 to 2440.15

Average AWC >5' per acre - 0

Standard Deviation - 0

Standard Error - 0

Confidence interval 80% - 0

Average Black Gum per acre all - 200.00

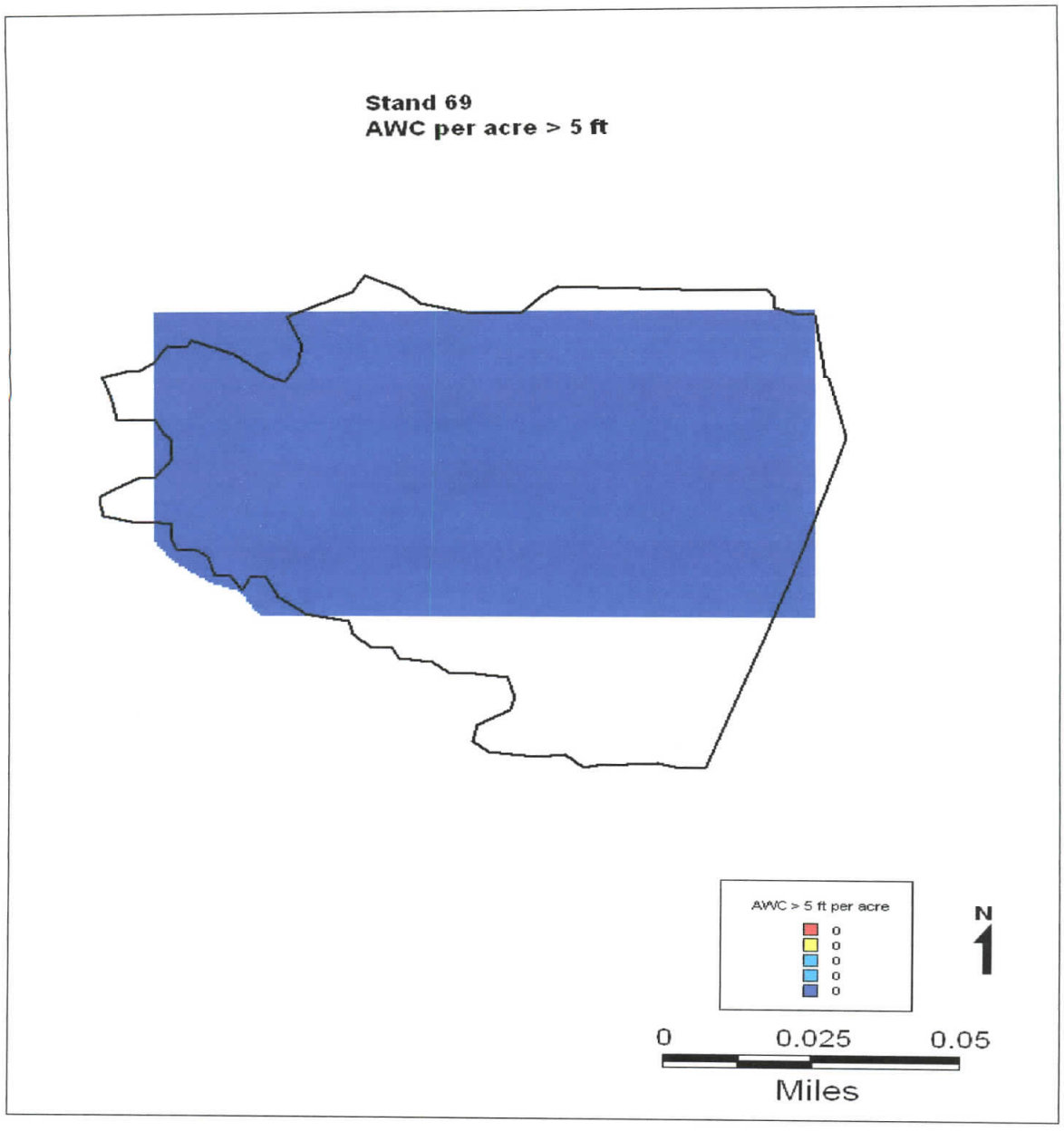
Confidence interval 80% - -56.31 to 456.31

Top five competitors

Green Brier---------- 12.75%
Fetter Bush---------- 12.50%
Bitter Gallberry--------- 9.50%
Wax Myrtle---------- 9.00%
Red Bay---------- 7.00%

Total percent cover - 54.25%

Management Recommendation - Level 4


Stand 69
AWC per acre > 5 ft
AWC > 5 ft per acre
0
0
0
0
0
N
1
0
0.025
0.05
Miles

Stand ID # - 72a

Location - Located on the Dare County Range east and west of Wolf Road.

Acreage - 77.60

Average AWC per acre all - 4453.27

Standard Deviation - 4175.70

Standard Error - 403.68

Confidence interval 80% - 3935.93 to 4970.61

Average AWC >5' per acre - 2135.51

Standard Deviation - 2372.77

Standard Error - 229.38

Confidence interval 80% - 1841.54 to 2429.48

Average Black Gum per acre all - 3228.97

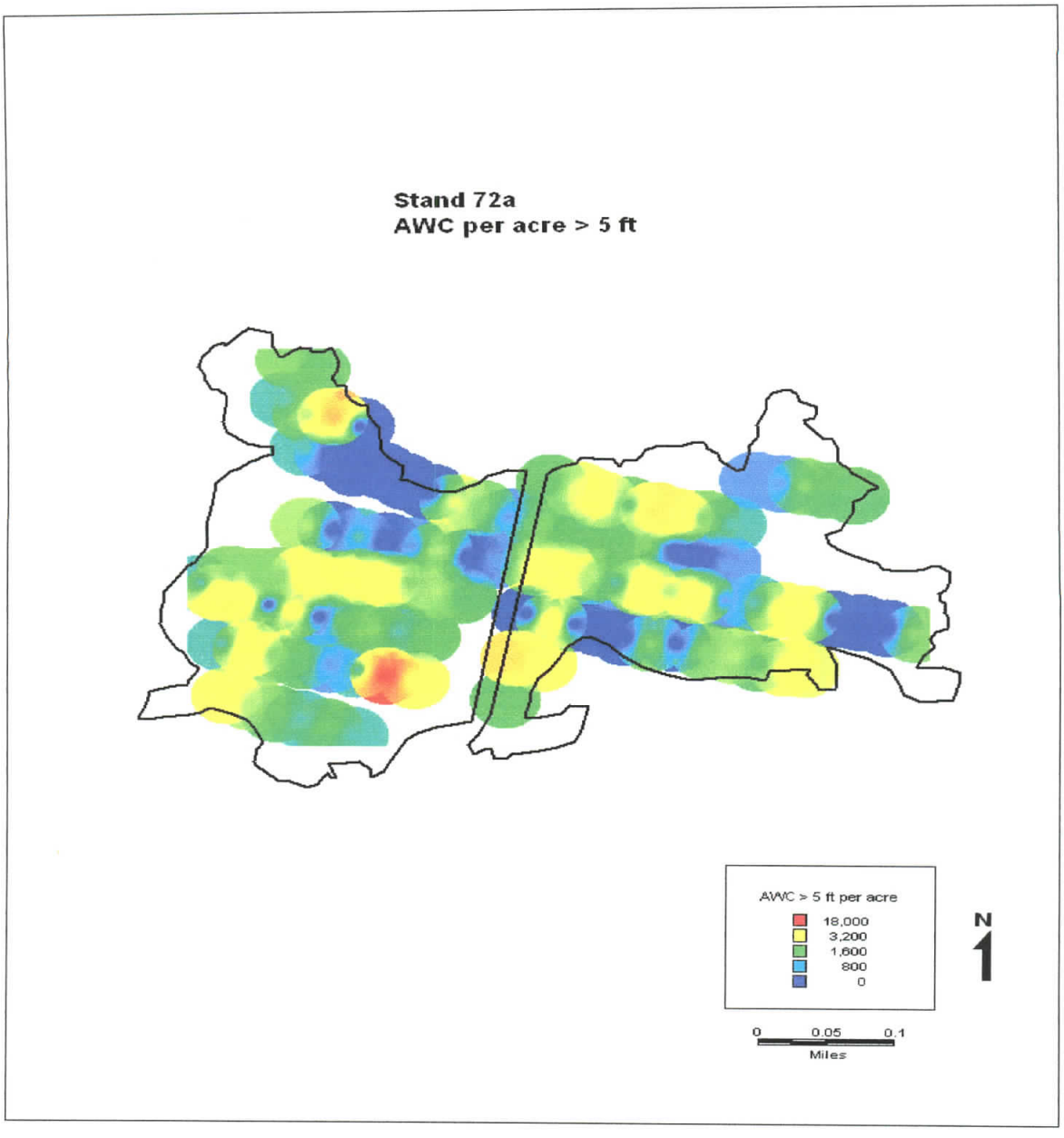
Confidence interval 80% - 2831.29 to 3626.65

Top five competitors

Fetter Bush---------- 16.61%
Black Gum---------- 13.60%
Bamboo Brier---------- 10.61%
Other---------- 4.11%
Red Maple---------- 4.04%

Total percent cover - 60.47%

Management Recommendation - Level 1


Stand 72a
AWC per acre > 5 ft
AWC > 5 ft per acre
18,000
3,200
1,600
800
0
N
0
0.05
0.1
Miles

Stand ID # - 73a

Location - Located on USFWS property south of Gator 5 at the west end.

Acreage - 62.98

Average AWC per acre all - 5634.02

Standard Deviation - 6894.11

Standard Error - 699.99

Confidence interval 80% - 4736.95 to 6531.09

Average AWC >5' per acre - 2108.25

Standard Deviation - 3132.68

Standard Error - 318.08

Confidence interval 80% - 1700.62 to 2515.88

Average Black Gum per acre all - 20.62

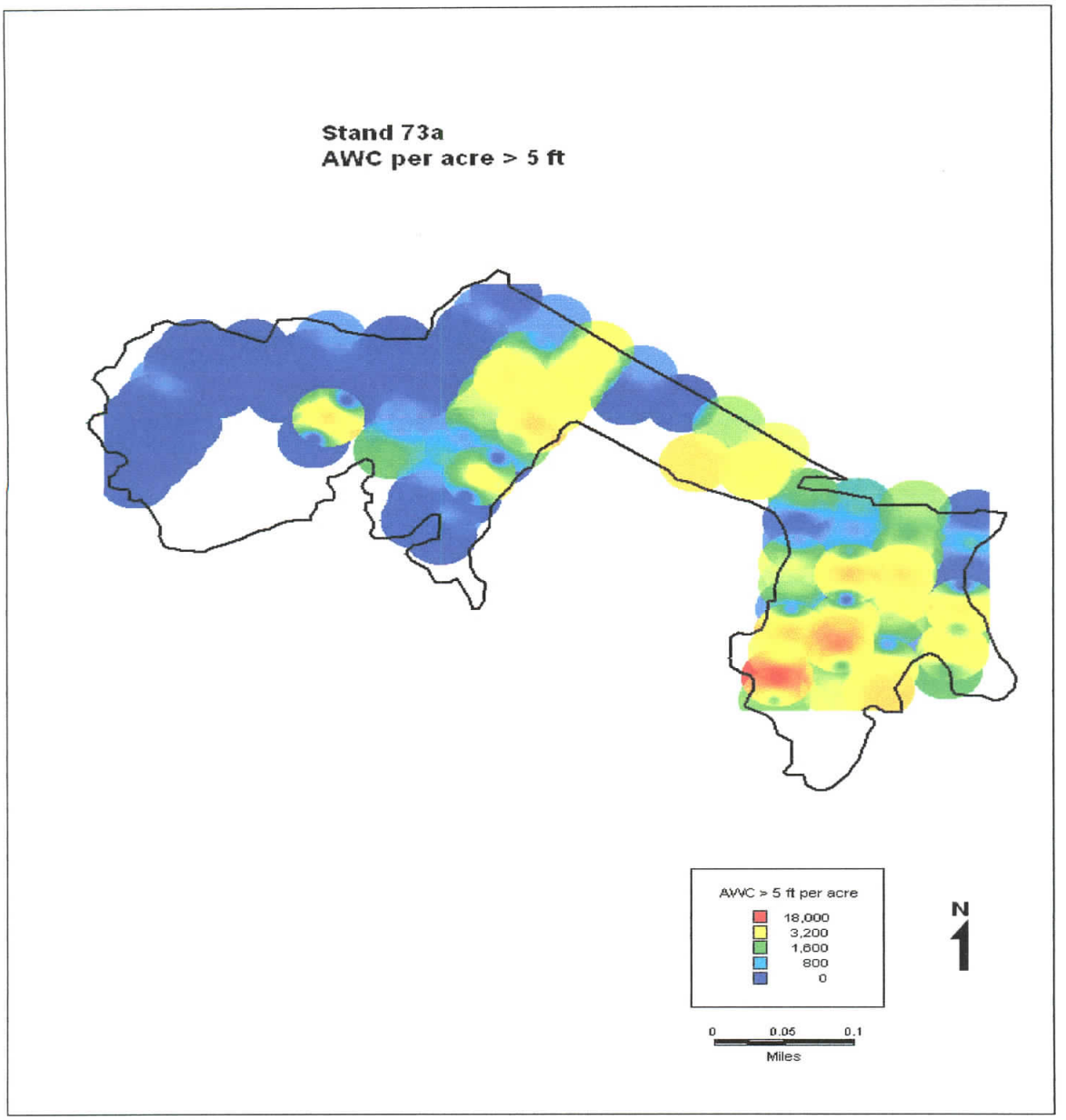
Confidence interval 80% - 4.58 to 36.66

Top five competitors

Fetter Bush---------- 20.59%
Bamboo Brier---------- 8.94%
Red Bay---------- 8.25%
Gallberry---------- 5.93%
Wax Myrtle---------- 5.34%

Total percent cover - 57.16%

Management Recommendation - Level 1


Stand 73a
AWC per acre > 5 ft
AWC > 5 ft per acre
18,000
3,200
1,600
800
0
N
0
0.05
0.1
Miles

Stand ID # - 74a

Location - Located on USFWS property north of Gator 5 at the west end.

Acreage - 23.79

Average AWC per acre all - 1032.26

Standard Deviation - 1231.09

Standard Error - 221.11

Confidence interval 80% - 748.90 to 1315.62

Average AWC >5' per acre - 1000.00

Standard Deviation - 1244.99

Standard Error - 223.61

Confidence interval 80% - 713.44 to 1286.56

Average Black Gum per acre all - 0.00

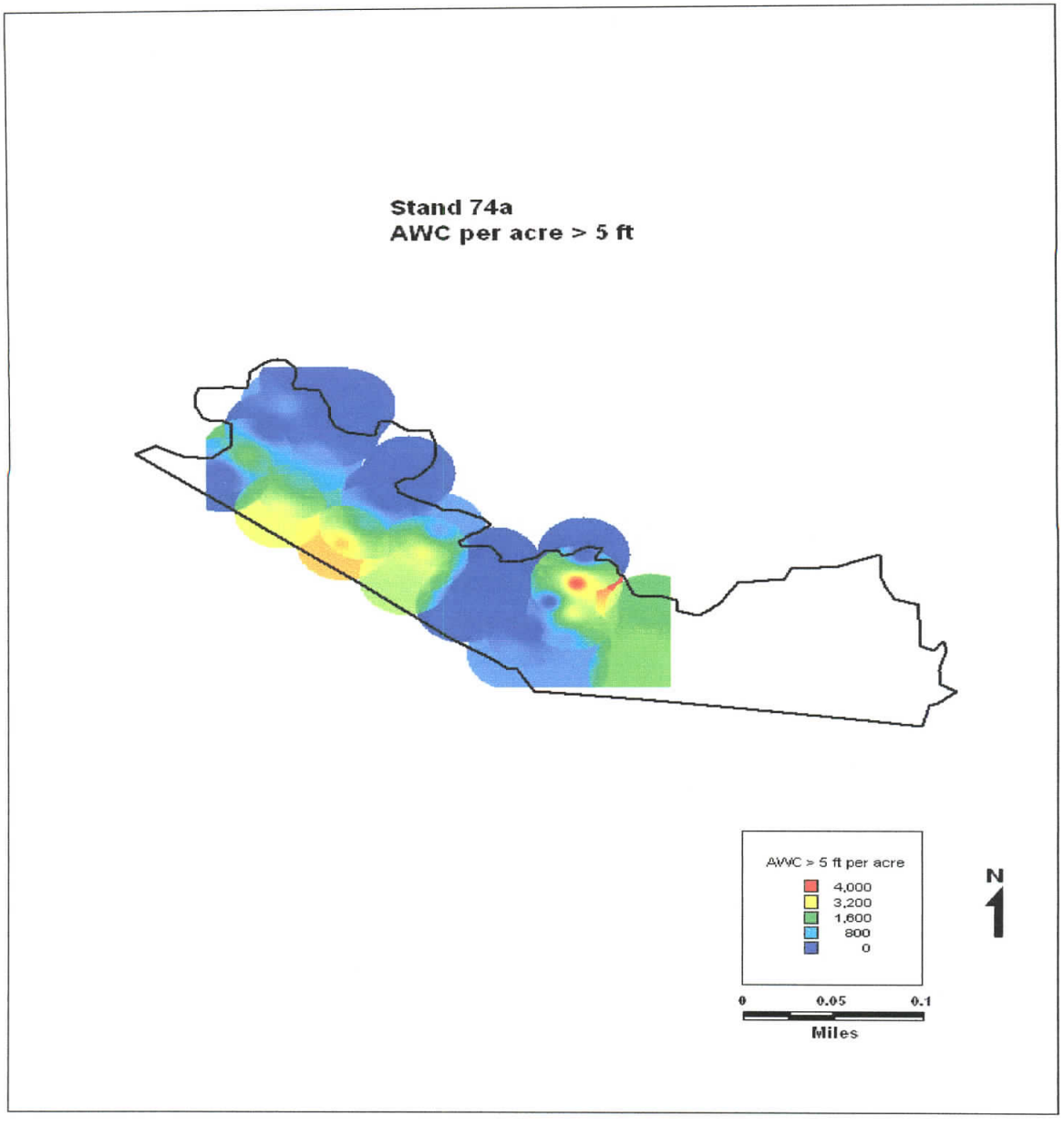
Confidence interval 80% - 0.00

Top five competitors

Fetter Bush---------- 11.85%
Gallberry---------- 9.19%
Red Bay---------- 7.74%
Wax Myrtle---------- 4.11%
Other---------- 2.26%

Total percent cover - 39.84%

Management Recommendation - Level 3


Stand 74a
AWC per acre > 5 ft
AWC > 5 ft per acre
4,000
3,200
1,600
800
0
0
0.05
0.1
Miles
N

Stand ID # - 75

Location - Located on USFWS property south of Gator 5.

Acreage - 10.86

Average AWC per acre all - 1090.91

Standard Deviation - 1446.00

Standard Error - 435.98

Confidence interval 80% - 532.17 to 1649.65

Average AWC >5' per acre - 90.91

Standard Deviation - 301.51

Standard Error - 90.91

Confidence interval 80% - -25.59 to 207.41

Average Black Gum per acre all - 318.18

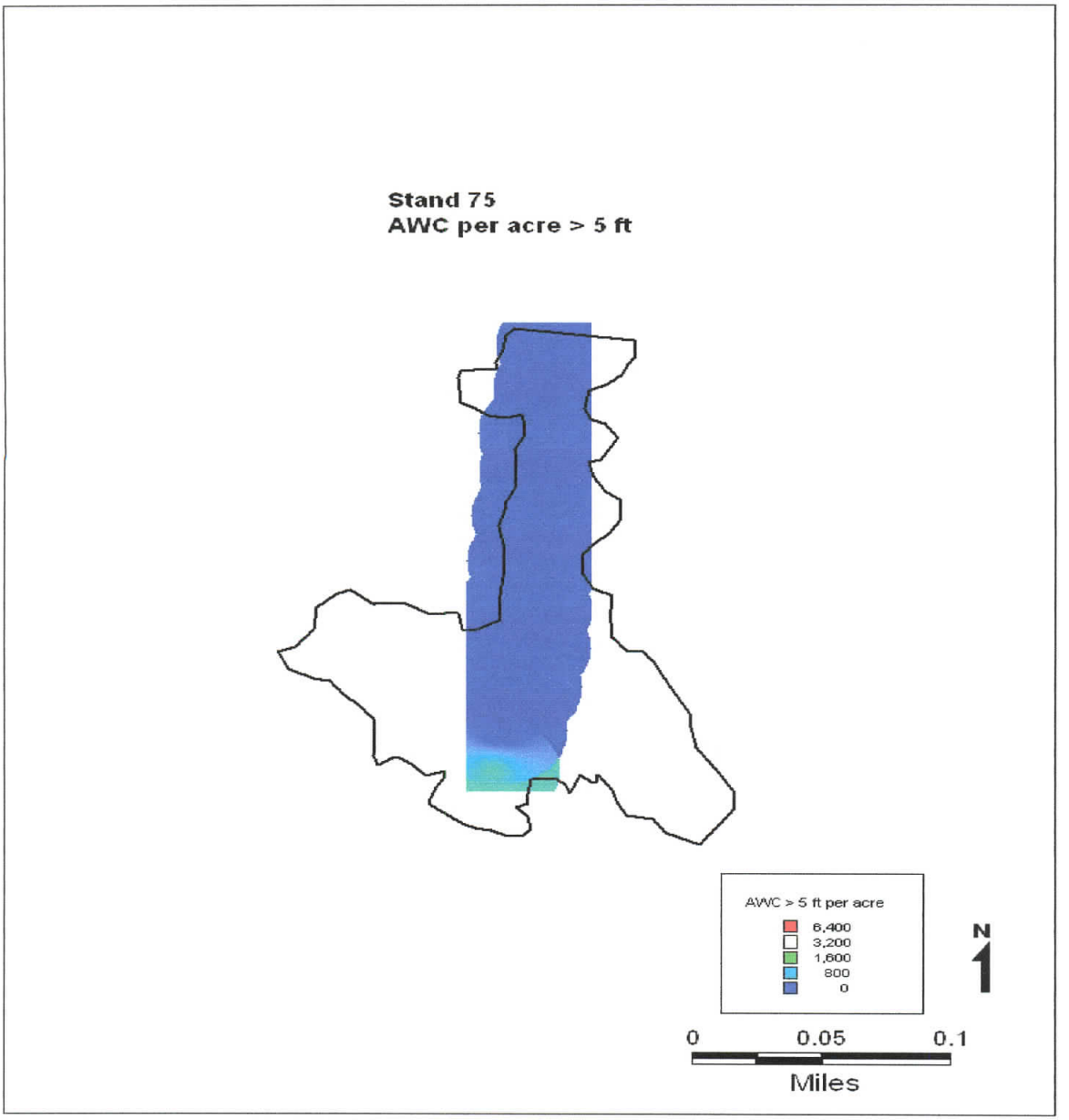
Confidence interval 80% - 41.25 to 595.11

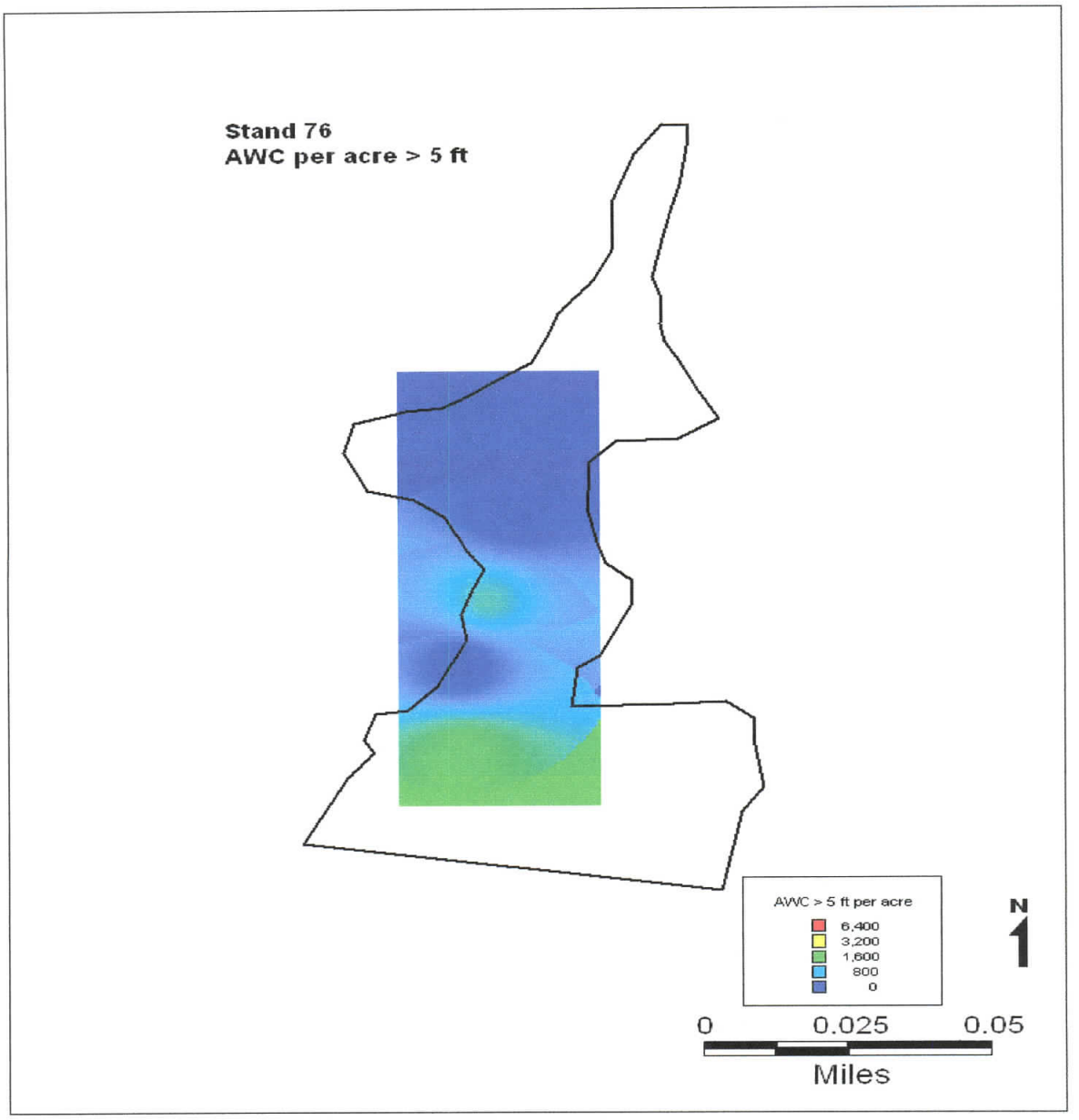
Top five competitors

Other---------- 14.09%
Red Maple---------- 7.73%
Fetter Bush---------- 5.23%
Bamboo Brier---------- 5.00%
Red Bay---------- 3.41%
Green Brier---------- 3.41%

Total percent cover - 44.77%

Management Recommendation - Level 4


Stand 75
AWC per acre > 5 ft
AWC > 5 ft per acre
6,400
3,200
1,600
800
0
N
0
0.05
0.1
Miles


Stand 76
AWC per acre > 5 ft
AWC > 5 ft per acre
6,400
3,200
1,600
800
0
N
0
0.025
0.05
Miles

Stand ID # - 76

Location - Located on USFWS property north of Gator 5.

Acreage - 3.41

Average AWC per acre all - 800.00

Standard Deviation - 1303.84

Standard Error - 583.10

Confidence interval 80% - 52.73 to 1547.27

Average AWC >5' per acre - 500.00

Standard Deviation - 707.11

Standard Error - 316.23

Confidence interval 80% - 94.74 to 905.26

Average Black Gum per acre all - 0

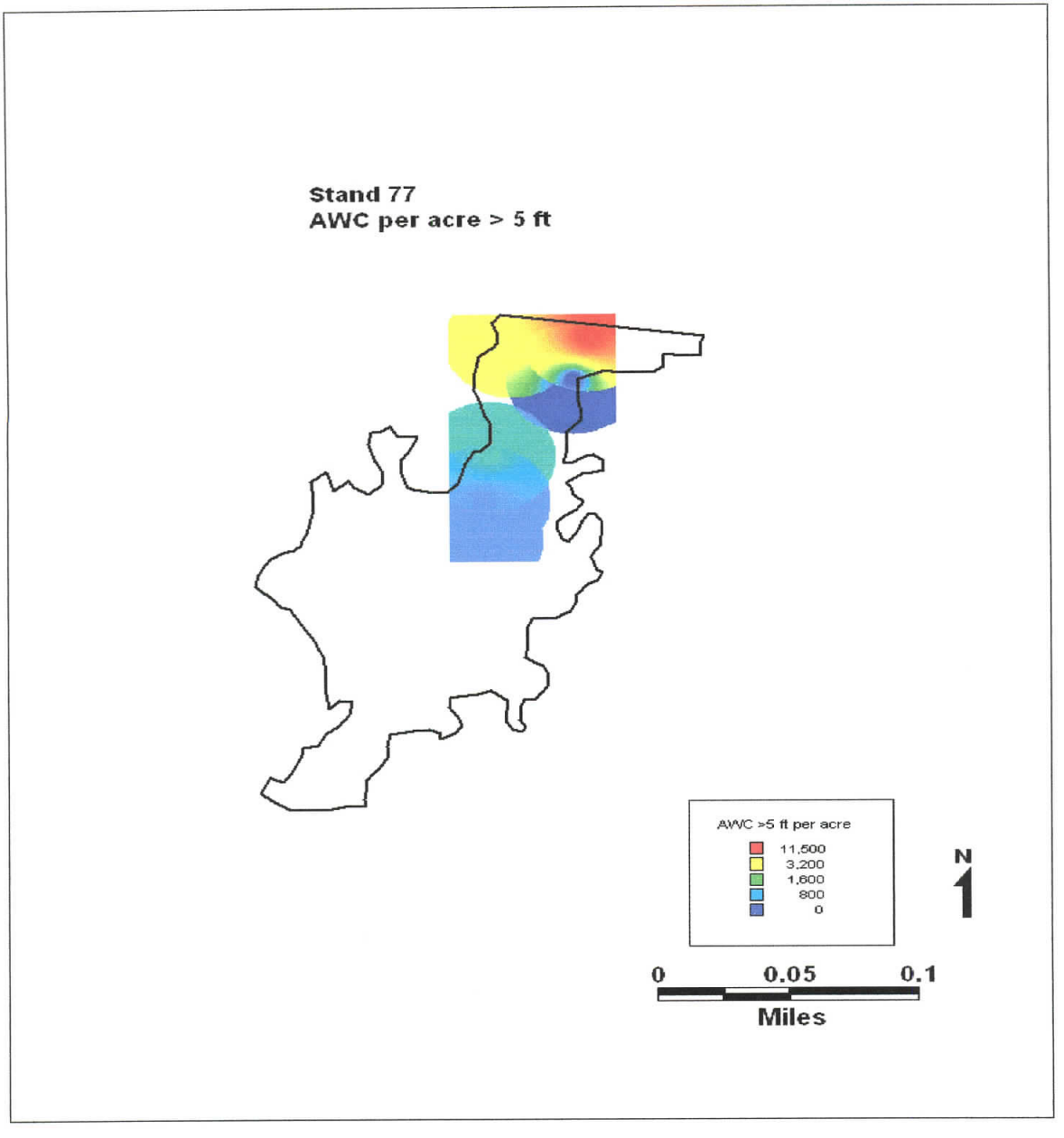
Confidence interval 80% - 0

Top five competitors

Fetter Bush---------- 13.50%
Red Bay---------- 7.50%
Red Maple---------- 3.50%
Other---------- 3.00%
Green Brier---------- 3.00%

Total percent cover - 31.50%

Management Recommendation - Level 4


Stand 77
AWC per acre > 5 ft
AWC >5 ft per acre
11,500
3,200
1,600
800
0
N
0
0.05
0.1
Miles

Stand ID # - 77

Location - Located on USFWS property south of Gator 5.

Acreage - 10.09

Average AWC per acre all - 3250.00

Standard Deviation - 4634.11

Standard Error - 1891.87

Confidence interval 80% - 825.47 to 5674.53

Average AWC >5' per acre - 2916.67

Standard Deviation - 4443.16

Standard Error - 1813.91

Confidence interval 80% - 592.05 to 5241.29

Average Black Gum per acre all - 250.00

Confidence interval 80% - -70.39 to 570.39

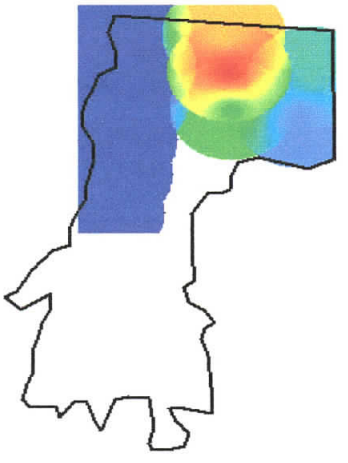
Top five competitors

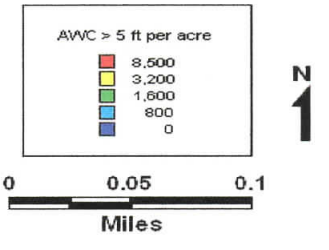
Fetter Bush---------- 11.25%
Green Brier---------- 8.75%
Red Bay---------- 5.42%
Gallberry---------- 5.00%
Bamboo Brier---------- 2.50%

Total percent cover - 42.50%

Management Recommendation - Level 3

Stand 78
AWC per acre > 5 ft





Stand ID # - 78

Location - Located on USFWS property south of Gator 5.

Acreage - 7.76

Average AWC per acre all - 3409.09

Standard Deviation - 5156.64

Standard Error - 1554.78

Confidence interval 80% - 1416.55 to 5401.63

Average AWC >5' per acre - 1500.00

Standard Deviation - 2756.81

Standard Error - 831.21

Confidence interval 80% - 434.76 to 2565.24

Average Black Gum per acre all - 227.27

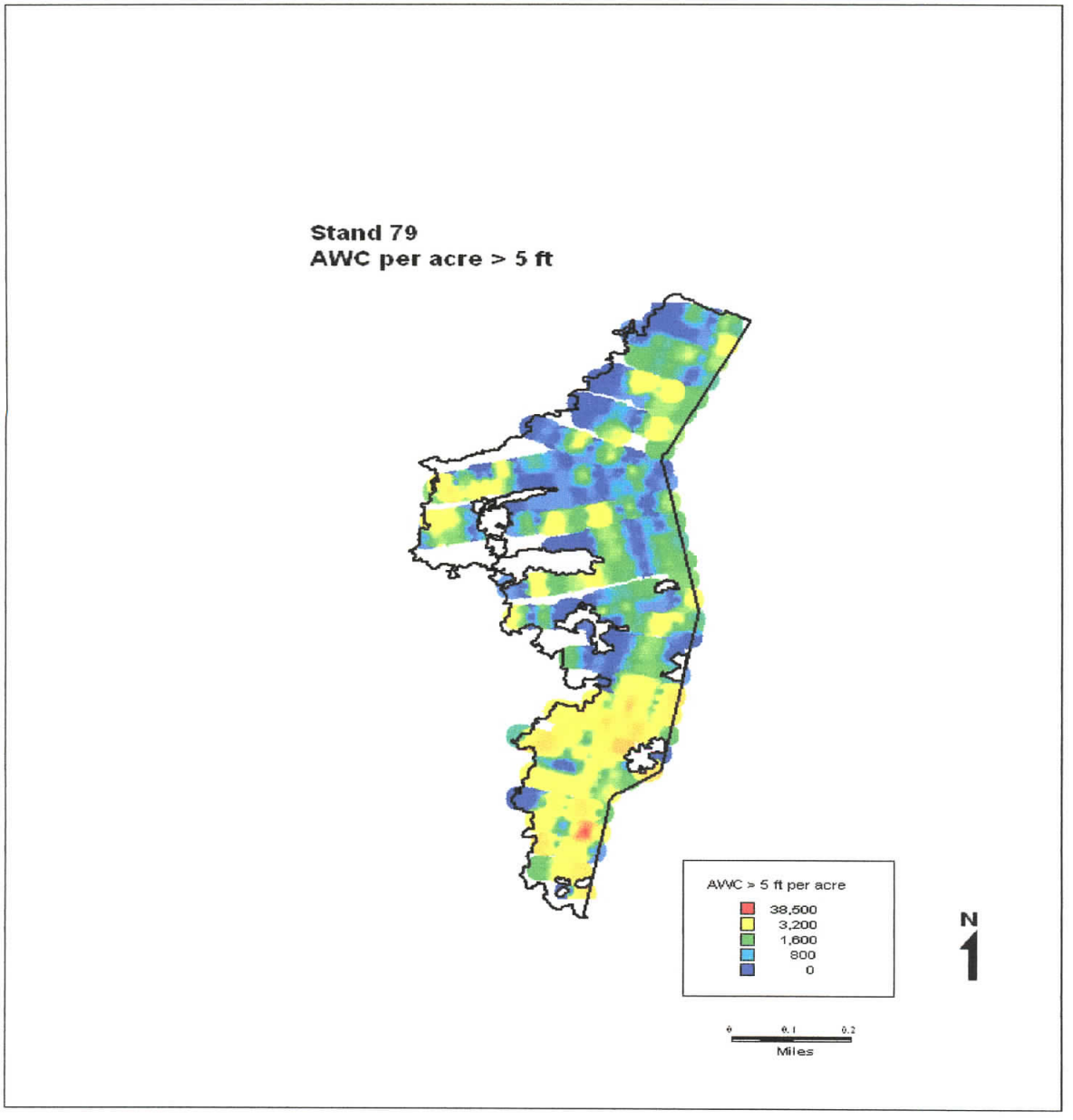
Confidence interval 80% - 46.78 to 407.76

Top five competitors

Fetter Bush---------- 14.77%
Other---------- 12.50%
Red Maple---------- 4.55%
Gallberry---------- 2.73%
Blueberry---------- 2.73%

Total percent cover - 46.36%

Management Recommendation - Level 3


Stand 79
AWC per acre > 5 ft
AWC > 5 ft per acre
38,500
3,200
1,600
800
0
N
0
0.1
0.2
Miles

Stand ID # - 79

Location - Located on USFWS property west of Nichols Road via Chip Road.

Acreage - 172.70

Average AWC per acre all - 9876.64

Standard Deviation - 11461.68

Standard Error - 657.37

Confidence interval 80% - 9034.18 to 10719.10

Average AWC >5' per acre - 2481.91

Standard Deviation - 3707.16

Standard Error - 212.62

Confidence interval 80% - 2209.43 to 2754.39

Average Black Gum per acre all - 226.97

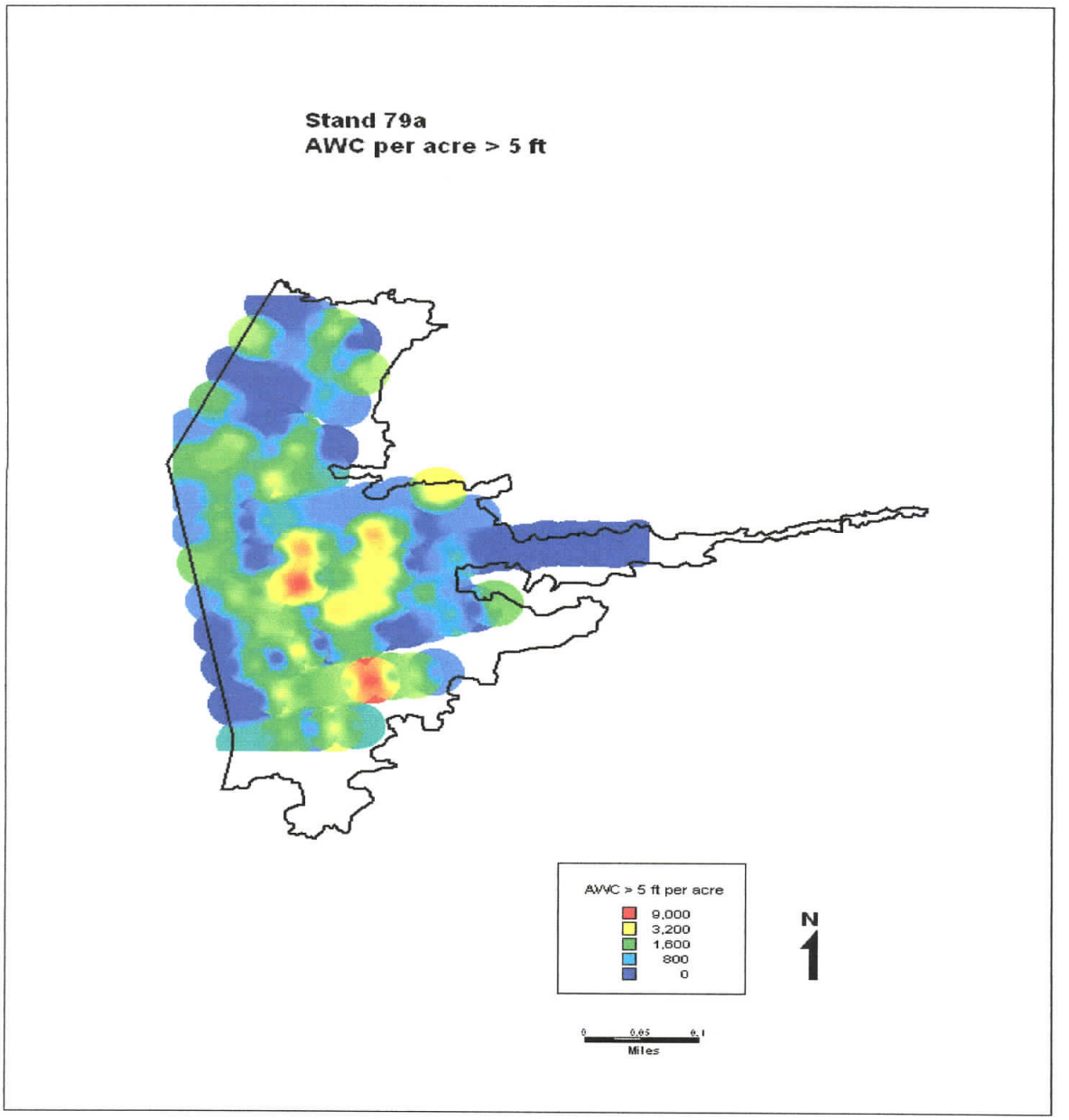
Confidence interval 80% - 182.72

Top five competitors

Fetter Bush---------- 14.82%
Wax Myrtle---------- 9.45%
Bitter Gallberry--------- 7.35%
Bamboo Brier---------- 7.16%
Red Bay---------- 5.36%

Total percent cover - 61.10%

Management Recommendation - Level 1


Stand 79a
AWC per acre > 5 ft
AWC > 5 ft per acre
9,000
3,200
1,600
800
0
N
0
0.05
0.1
Miles

Stand ID # - 79a

Location - Located on USFWS property east of Nichols Road via Chip Road

Acreage - 77.02

Average AWC per acre all - 4537.82

Standard Deviation - 4217.18

Standard Error - 386.59

Confidence interval 80% - 4042.39 to 5033.25

Average AWC >5' per acre - 1336.13

Standard Deviation - 1607.86

Standard Error - 147.39

Confidence interval 80% - 1147.24 to 1525.02

Average Black Gum per acre all - 525.21

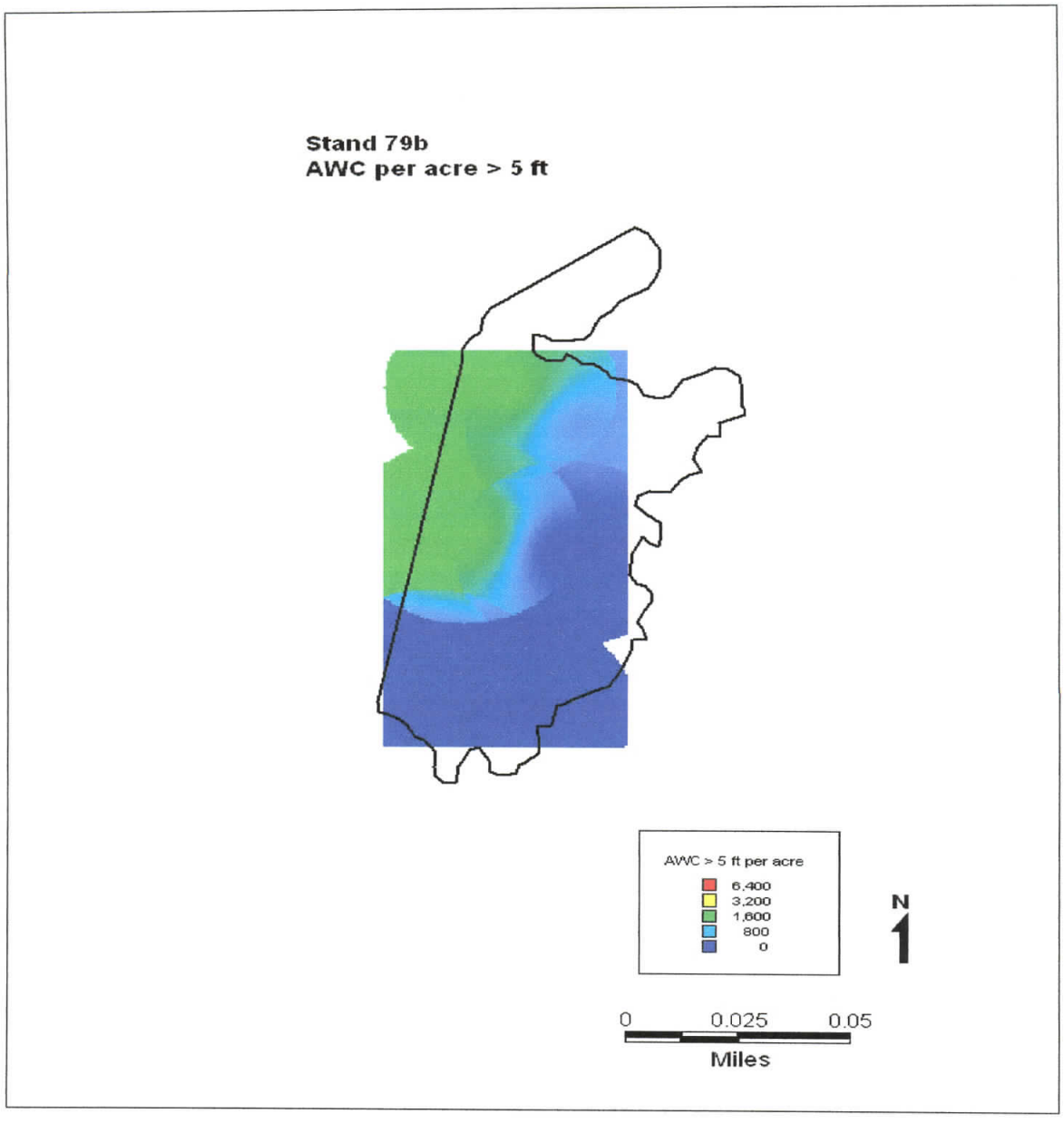
Confidence interval 80% - 390.82 to 659.60

Top five competitors

Bitter Gallberry--------- 11.03%
Fetter Bush---------- 9.52%
Wax Myrtle---------- 8.49%
Green Brier---------- 7.33%
Other---------- 5.57%

Total percent cover - 61.41%

Management Recommendation - Level 1


Stand 79b
AWC per acre > 5 ft
AWC > 5 ft per acre
6,400
3,200
1,600
800
0
N
0
0.025
0.05
Miles

Stand ID # - 79b

Location - Located on USFWS property east of Nichols Road via Chip Road.

Acreage - 3.91

Average AWC per acre all - 6000.00

Standard Deviation - 4658.33

Standard Error - 1901.75

Confidence interval 80% - 3562.81 to 8437.19

Average AWC >5' per acre - 583.33

Standard Deviation - 735.98

Standard Error - 300.46

Confidence interval 80% - 198.27 to 968.39

Average Black Gum per acre all - 166.67

Confidence interval 80% - -46.92 to 380.26

Top five competitors

Fetter Bush---------- 39.58%
Gallberry---------- 12.50%
Bitter Gallberry--------- 11.25%
Other---------- 6.25%
Red Bay---------- 5.00%

Total percent cover - 82.92%

Management Recommendation - Level 4

Stand ID # - 80

Location - Jointly owned. Located west of Whipping Creek Road.

Acreage - 25.10

Average AWC per acre all - 1545.45

Standard Deviation - 1932.86

Standard Error - 412.09

Confidence interval 80% - 1017.34 to 2073.56

Average AWC >5' per acre - 340.91

Standard Deviation - 564.56

Standard Error - 120.36

Confidence interval 80% - 186.66 to 495.16

Average Black Gum per acre all - 750.00

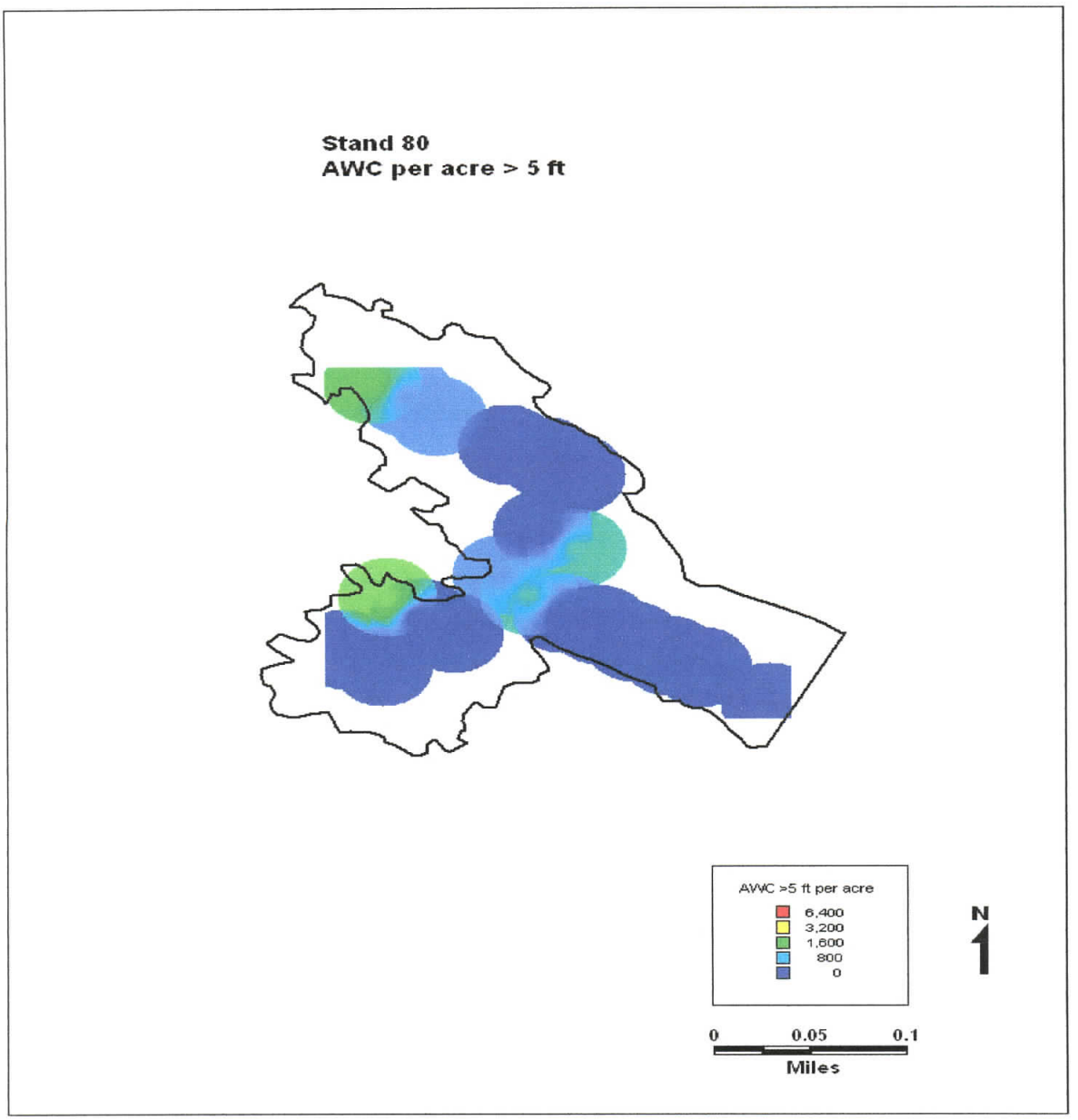
Confidence interval 80% - 438.05 to 1061.95

Top five competitors

Wool Grass---------- 19.43%
Red Maple---------- 8.41%
Bitter Gallberry--------- 4.77%
Fetter Bush---------- 4.09%
Black Gum---------- 3.98%

Total percent cover - 53.98%

Management Recommendation - Level 4


Stand 80
AWC per acre > 5 ft
AWC >5 ft per acre
6,400
3,200
1,600
800
0
N
1
0
0.05
0.1
Miles

Stand ID # - 81

Location - Located on the Dare County Range west of Whipping Creek Road.

Acreage - 19.26

Average AWC per acre all - 3904.76

Standard Deviation - 3088.77

Standard Error - 674.02

Confidence interval 80% - 3040.96 to 4768.56

Average AWC >5' per acre - 1523.81

Standard Deviation - 1470.34

Standard Error - 320.85

Confidence interval 80% - 1112.62 to 1935.00

Average Black Gum per acre all - 1142.86

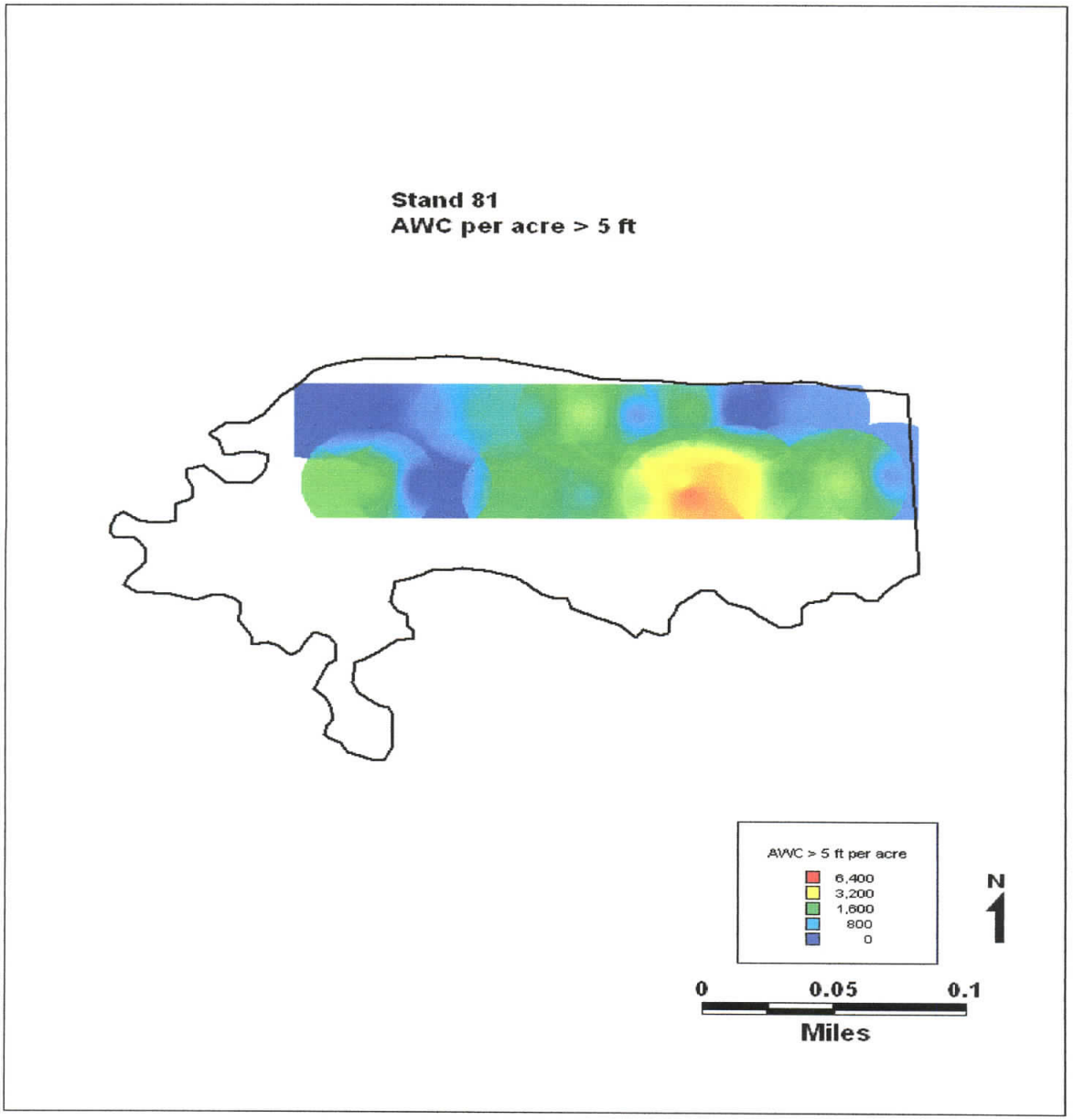
Confidence interval 80% - 817.50 to 1468.22

Top five competitors

Bitter Gallberry--------- 15.36%
Other---------- 15.12%
Red Maple---------- 10.60%
Fetter Bush---------- 9.05%
Green Brier---------- 5.95%

Total percent cover - 71.19%

Management Recommendation - Level 1


Stand 81
AWC per acre > 5 ft
AWC > 5 ft per acre
6,400
3,200
1,600
800
0
N
0
0.05
0.1
Miles

Stand ID # - 82

Location - Located on the Dare County Range south of Nichols Road.

Acreage - 44.59

Average AWC per acre all - 1007.46

Standard Deviation - 1550.89

Standard Error - 189.47

Confidence interval 80% - 764.64 to 1250.28

Average AWC >5' per acre - 320.90

Standard Deviation - 555.90

Standard Error - 67.84

Confidence interval 80% - 233.96 to 407.84

Average Black Gum per acre all - 432.84

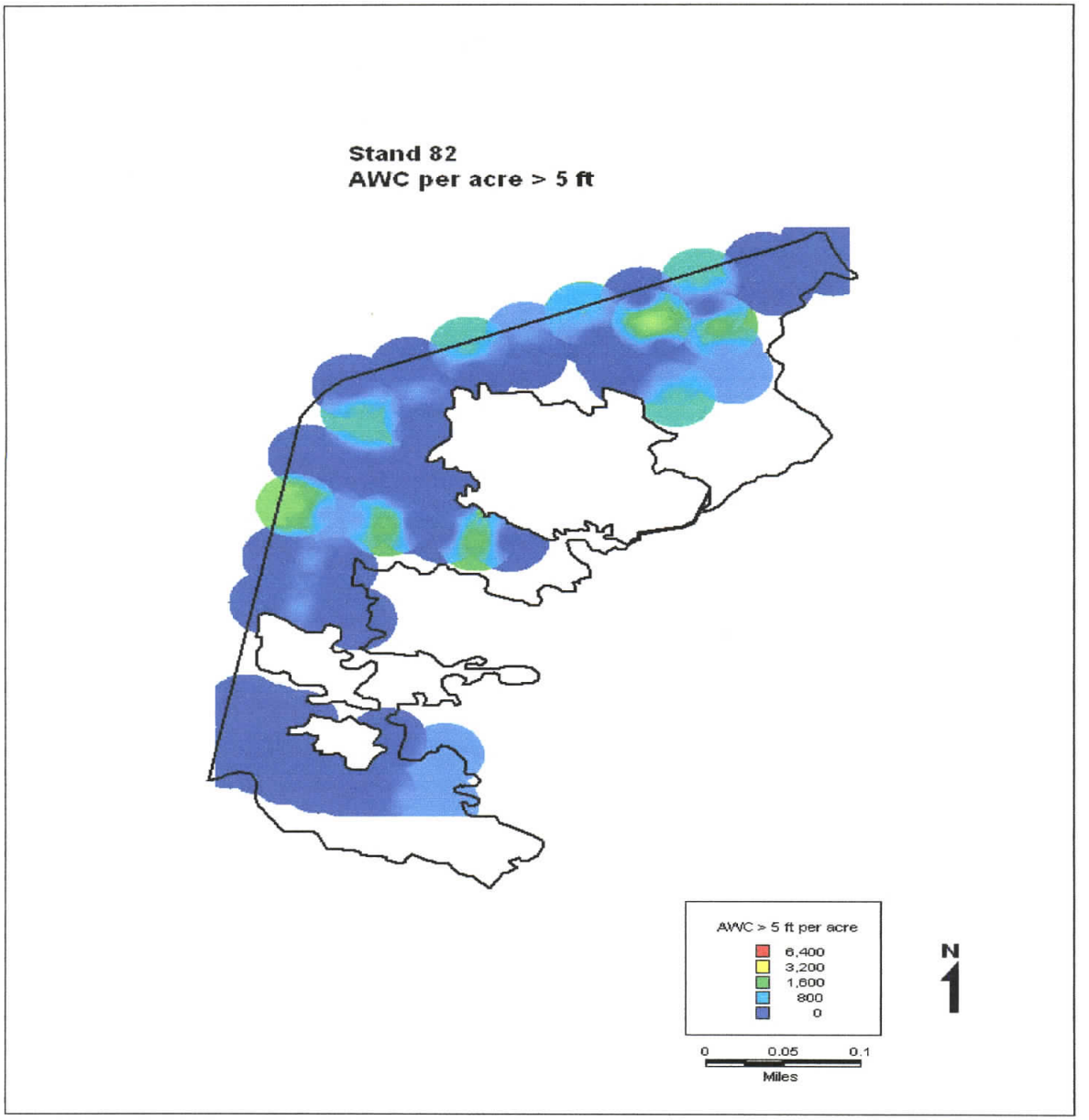
Confidence interval 80% - 261.06 to 604.62

Top five competitors

Wax Myrtle---------- 20.00%
Fetter Bush---------- 16.01%
Green Brier---------- 11.57%
Red Bay---------- 4.81%
Bamboo Brier---------- 3.73%

Total percent cover - 72.05%

Management Recommendation - Level 4


Stand 82
AWC per acre > 5 ft
AWC > 5 ft per acre
6,400
3,200
1,600
800
0
0
0.05
0.1
Miles
N
1

Stand ID # - 83

Location - Located on the Dare County Range north of Nichols Road.

Acreage - 79.21

Average AWC per acre all - 3404.11

Standard Deviation - 3839.14

Standard Error - 317.73

Confidence interval 80% - 2996.92 to 3811.30

Average AWC >5' per acre - 938.36

Standard Deviation - 1480.79

Standard Error - 122.55

Confidence interval 80% - 781.31 to 1095.41

Average Black Gum per acre all - 393.84

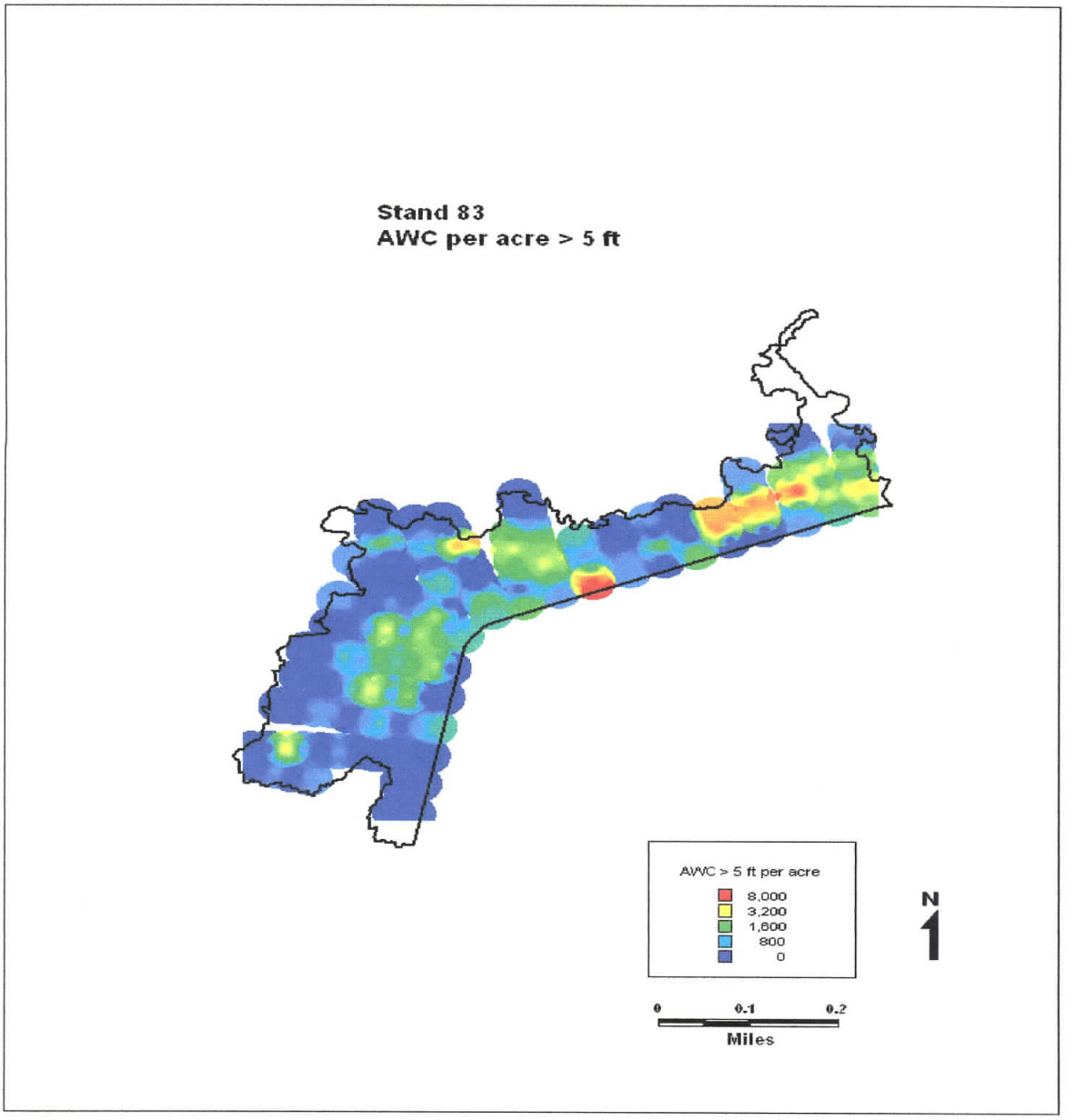
Confidence interval 80% - 306.16 to 481.52

Top five competitors

Fetter Bush---------- 17.02%
Wax Myrtle---------- 15.21%
Bitter Gallberry--------- 11.23%
Green Brier---------- 8.29%
Red Bay---------- 4.35%

Total percent cover - 68.46%

Management Recommendation - Level 2


Stand 83
AWC per acre > 5 ft
AWC > 5 ft per acre
8,000
3,200
1,600
800
0
N
0
0.1
0.2
Miles

Stand ID # - 84

Location - Located on the Dare County Range west of Whipping Creek Road, south of Whipping Creek Bridge.

Acreage - 3.59

Average AWC per acre all - 1100.00

Standard Deviation - 1431.78

Standard Error - 640.31

Confidence interval 80% - 279.41 to 1920.59

Average AWC >5' per acre - 200.00

Standard Deviation - 447.21

Standard Error - 200.00

Confidence interval 80% - -56.31 to 456.31

Average Black Gum per acre all - 100.00

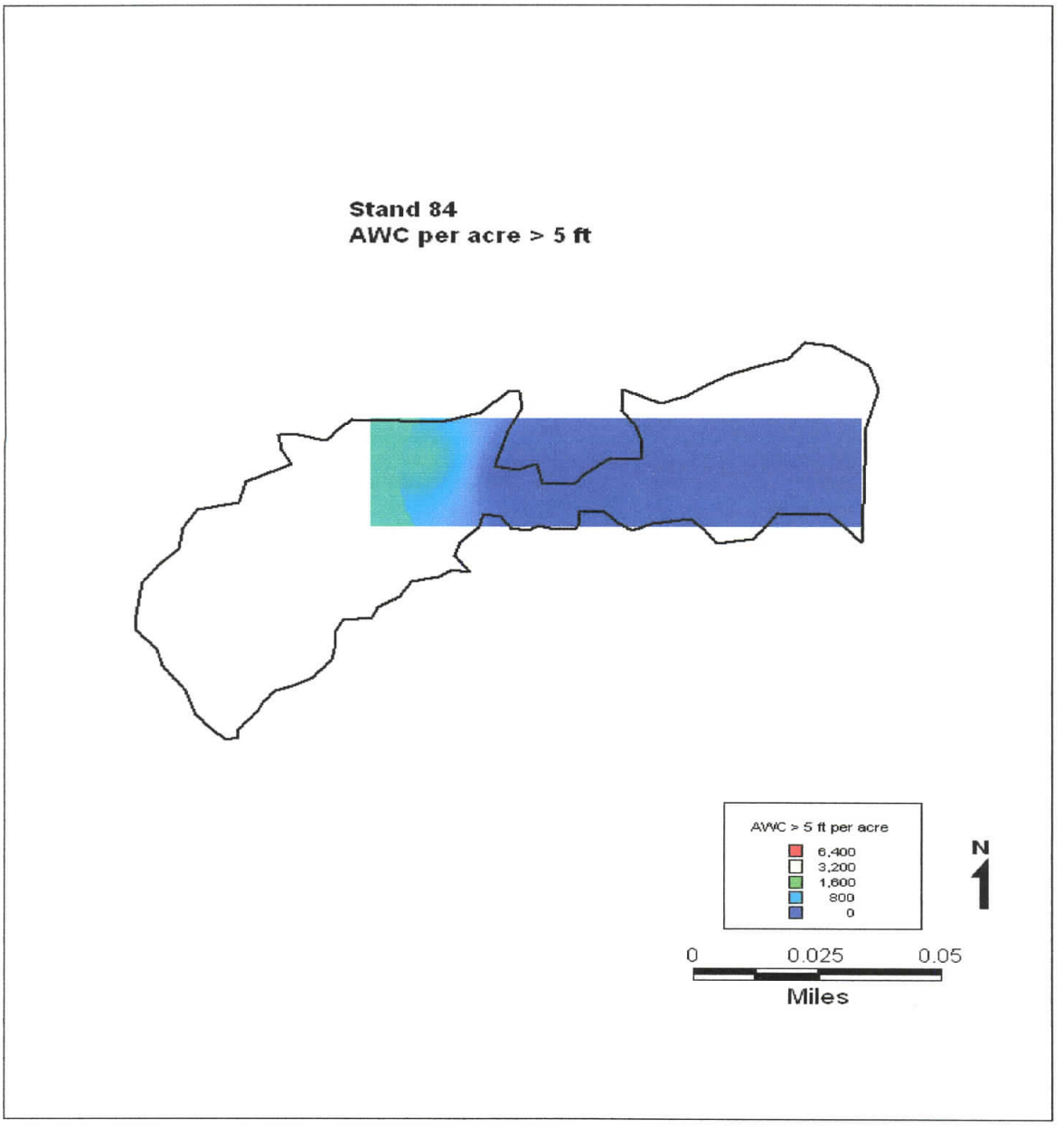
Confidence interval 80% - -28.16 to 228.16

Top five competitors

Red Maple---------- 12.00%
Other---------- 8.50%
Blueberry---------- 7.50%
Bitter Gallberry--------- 3.00%
Fetter Bush---------- 0.50%

Total percent cover - 34.00%

Management Recommendation - Level 4


Stand 84
AWC per acre > 5 ft
AWC > 5 ft per acre
6,400
3,200
1,600
800
0
N
0
0.025
0.05
Miles

Stand ID # - 85

Location - Located on the Dare County Range south of Hooper Road.

Acreage - 4.74

Average AWC per acre all - 6875.00

Standard Deviation - 5677.07

Standard Error - 2838.54

Confidence interval 80% - 3237.27 to 10512.73

Average AWC >5' per acre - 2000.00

Standard Deviation - 2483.28

Standard Error - 1241.64

Confidence interval 80% - 408.78 to 3591.22

Average Black Gum per acre all - 625.00

Confidence interval 80% - -175.97 to 1425.97

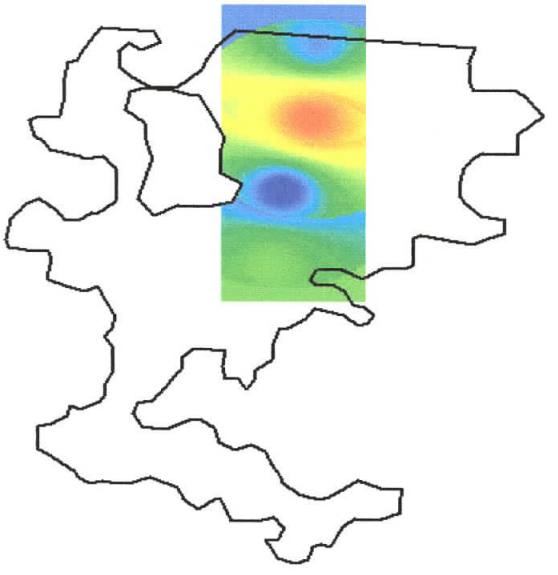
Top five competitors

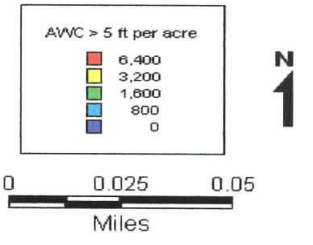
Wax Myrtle---------- 16.88%
Red Maple---------- 13.75%
Fetter Bush---------- 11.25%
Bamboo Brier---------- 10.00%
Green Brier---------- 0.63%

Total percent cover - 52.50%

Management Recommendation - Level 4

Stand 85
AWC per acre > 5 ft





Stand ID # - 86

Location - Jointly owned. Located east and west of Mason Road.

Acreage - 29.57

Average AWC per acre all - 5067.57

Standard Deviation - 6288.62

Standard Error - 1033.84

Confidence interval 80% - 3742.65 to 6392.49

Average AWC >5' per acre - 1216.22

Standard Deviation - 2811.50

Standard Error - 462.21

Confidence interval 80% - 623.88 to 1808.56

Average Black Gum per acre all - 162.16

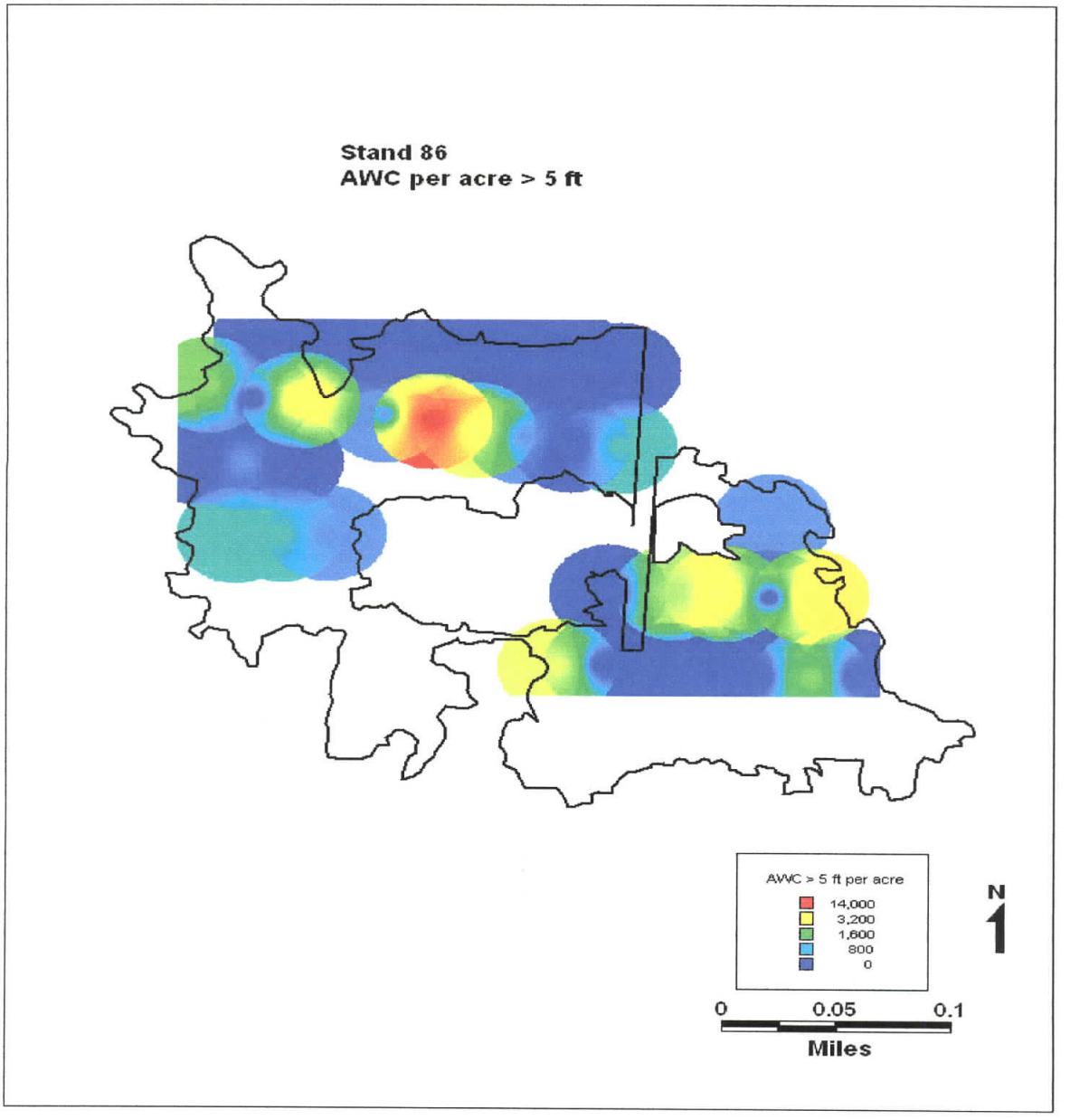
Confidence interval 80% - 66.61 to 257.71

Top five competitors

Fetter Bush---------- 25.34%
Wax Myrtle---------- 12.03%
Bamboo Brier---------- 6.62%
Other---------- 4.66%
Red Maple---------- 4.46%

Total percent cover - 68.51%

Management Recommendation - Level 2


Stand 86
AWC per acre > 5 ft
AWC > 5 ft per acre
14,000
3,200
1,600
800
0
N
0
0.05
0.1
Miles

Stand ID # - 87

Location - Jointly owned. Located east and west of Mason Road/Hooper Road intersection.

Acreage - 15.96

Average AWC per acre all - 3326.92

Standard Deviation - 3376.22

Standard Error - 675.24

Confidence interval 80% - 2461.56 to 4192.28

Average AWC >5' per acre - 846.15

Standard Deviation - 1324.91

Standard Error - 264.98

Confidence interval 80% - 506.56 to 1185.74

Average Black Gum per acre all - 519.23

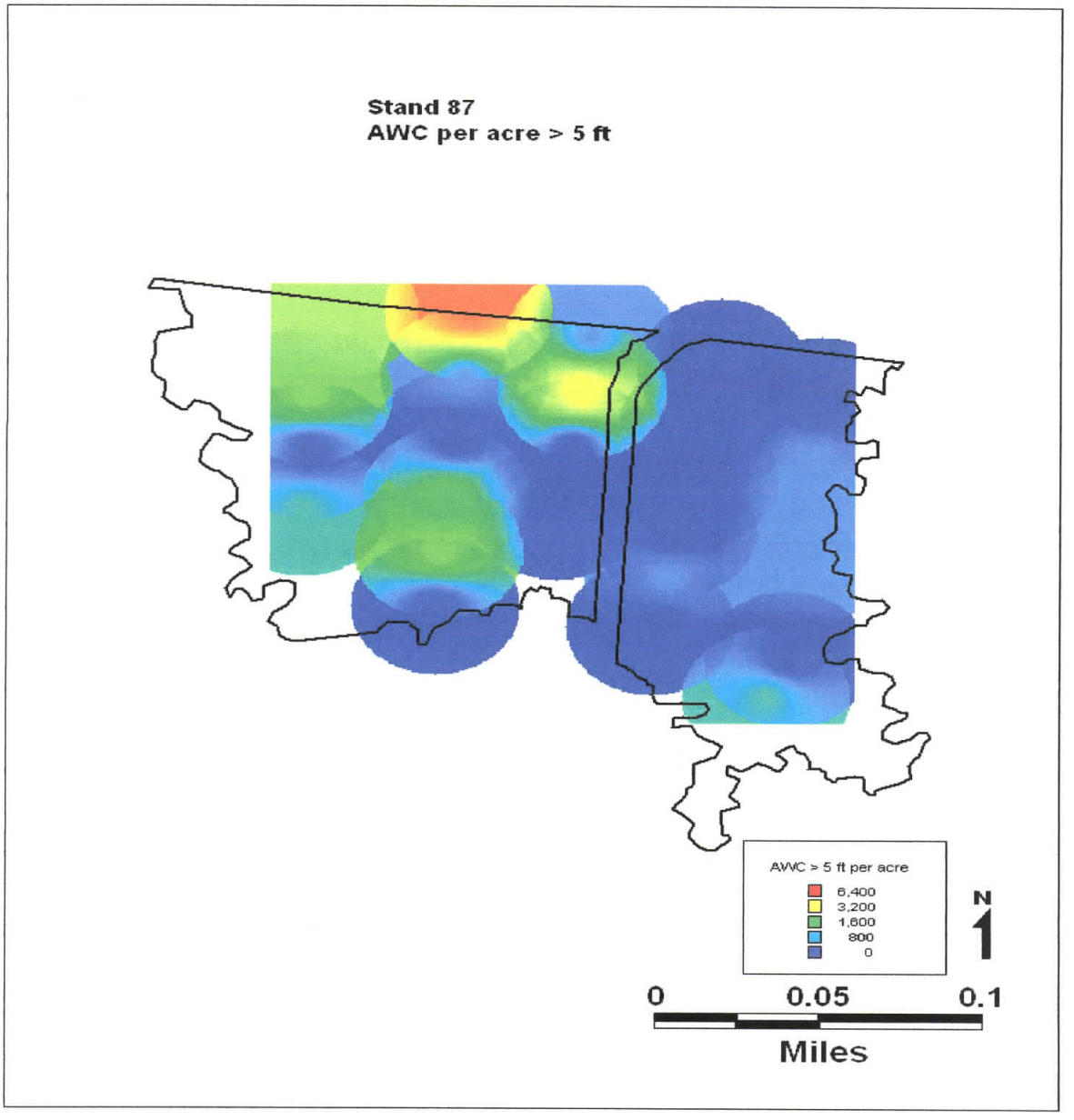
Confidence interval 80% - 285.77 to 752.69

Top five competitors

Fetter Bush---------- 27.88%
Wax Myrtle---------- 10.67%
Bamboo Brier---------- 8.56%
Red Maple---------- 5.58%
Red Bay---------- 4.33%

Total percent cover - 72.12%

Management Recommendation - Level 2


Stand 87
AWC per acre > 5 ft
AWC > 5 ft per acre
6,400
3,200
1,600
800
0
N
0
0.05
0.1
Miles

Stand ID # - 88

Location - Jointly owned. Located north of the Mason Road/Hooper Road intersection.

Acreage - 17.18

Average AWC per acre all - 2125.00

Standard Deviation - 5618.78

Standard Error - 1146.93

Confidence interval 80% - 655.15 to 3594.85

Average AWC >5' per acre - 500.00

Standard Deviation - 1093.46

Standard Error - 223.20

Confidence interval 80% - 213.96 to 786.04

Average Black Gum per acre all - 229.17

Confidence interval 80% - 95.68 to 362.66

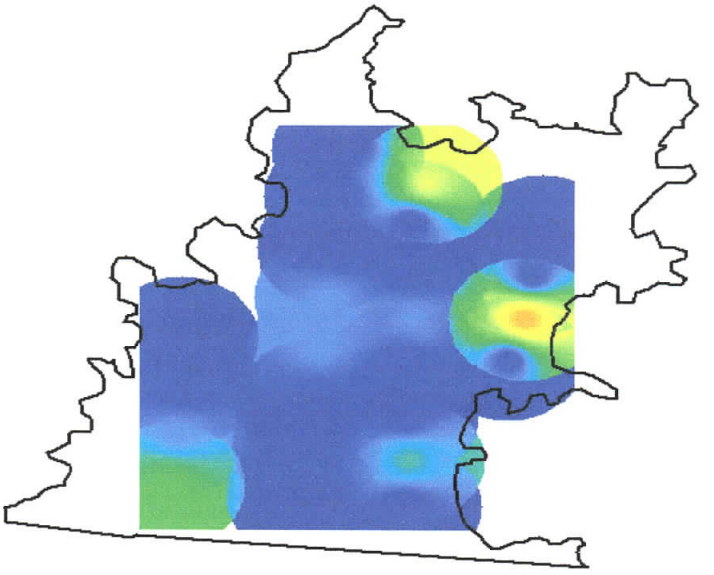
Top five competitors

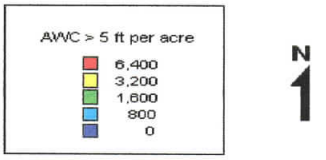
Green Brier---------- 22.81%
Fetter Bush---------- 16.04%
Wax Myrtle---------- 8.96%
Bamboo Brier---------- 5.10%
Bitter Gallberry--------- 3.23%

Total percent cover - 64.76

Management Recommendation - Level 4

Stand 88
AWC per acre > 5 ft





Stand ID # - 89

Location - Located on the Dare County Range south of Hooper Road.

Acreage - 42.81

Average AWC per acre all - 5031.25

Standard Deviation - 5435.70

Standard Error - 784.58

Confidence interval 80% - 4025.78 to 6036.72

Average AWC >5' per acre - 2531.25

Standard Deviation - 2842.32

Standard Error - 410.25

Confidence interval 80% - 2005.49 to 3057.01

Average Black Gum per acre all - 270.83

Confidence interval 80% - 156.42 to 698.08

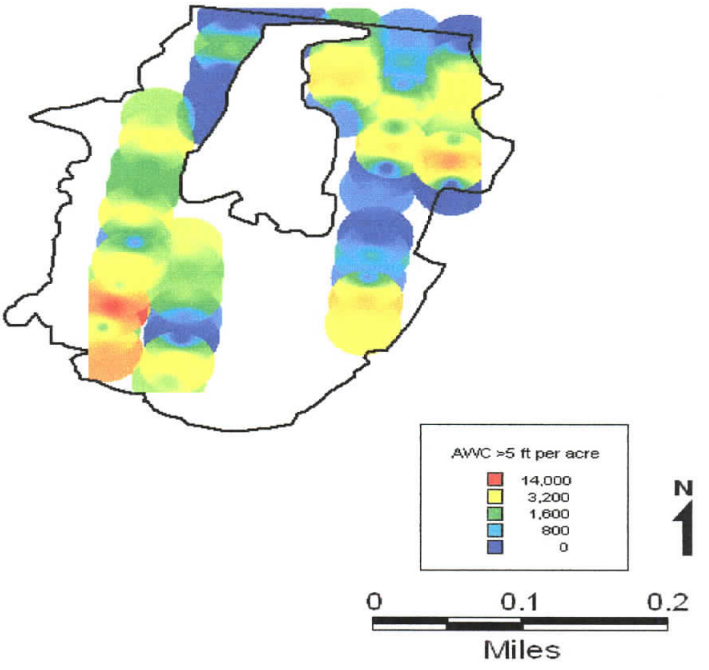
Top five competitors

Wax Myrtle---------- 19.48%
Fetter Bush---------- 17.55%
Green Brier---------- 10.57%
Bitter Gallberry--------- 8.54%
Other---------- 3.75%

Total percent cover - 72.34%

Management Recommendation - Level 1

Stand 89
AWC per acre > 5 ft



Stand ID # - 90

Location - Located on the Dare County Range north of Hooper Road.

Acreage - 14.46

Average AWC per acre all - 2259.26

Standard Deviation - 1756.15

Standard Error - 337.97

Confidence interval 80% - 1826.13 to 2692.39

Average AWC >5' per acre - 1055.56

Standard Deviation - 1094.86

Standard Error - 210.71

Confidence interval 80% - 785.53 to 1325.59

Average Black Gum per acre all - 722.22

Confidence interval 80% - 546.71 to 897.73

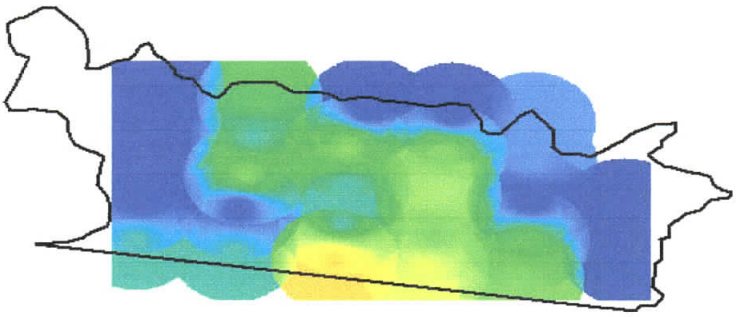
Top five competitors

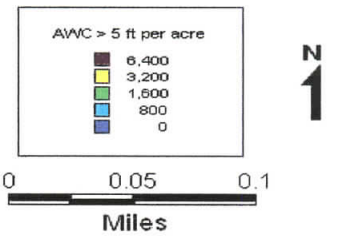
Bamboo Brier---------- 20.74%
Fetter Bush---------- 13.33%
Wax Myrtle---------- 8.70%
Green Brier---------- 6.20%
Red Bay---------- 5.19%

Total percent cover - 64.81

Management Recommendation - Level 2

Stand 90
AWC per acre > 5 ft





Stand ID # - 91

Location - Jointly owned. Located west of H&B Road, north of Richmond Road/Gator 1 intersection.

Acreage - 134.40

Average AWC per acre all - 4434.64

Standard Deviation - 4501.35

Standard Error - 363.91

Confidence interval 80% - 3968.27 to 4901.01

Average AWC >5' per acre - 1549.02

Standard Deviation - 1599.51

Standard Error - 129.31

Confidence interval 80% - 1383.30 to 1714.74

Average Black Gum per acre all - 908.50

Confidence interval 80% - 690.29 to 1126.71

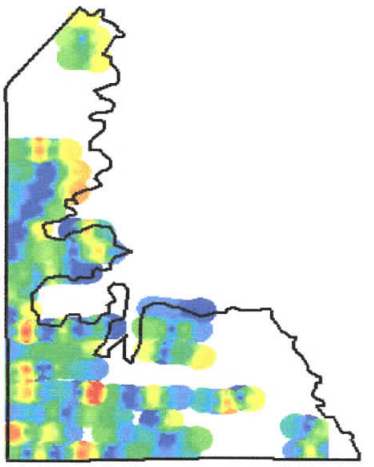
Top five competitors

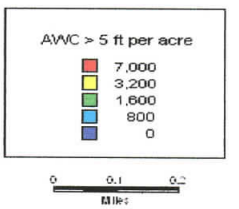
Fetter Bush---------- 20.46%
Green Brier---------- 12.35%
Other---------- 4.18%
Black Gum---------- 3.97%
Bamboo Brier---------- 3.56%
Wax Myrtle---------- 3.56%

Total percent cover - 55.47%

Management Recommendation - Level 1

Stand 91
AWC per acre > 5 ft





N
1

Stand ID # - 92

Location - Located on the Dare County Range west of H&B, south of Gator 4.

Acreage - 94.28

Average AWC per acre all - 2121.95

Standard Deviation - 2467.28

Standard Error - 222.47

Confidence interval 80% - 1836.85 to 2407.05

Average AWC >5' per acre - 1227.64

Standard Deviation - 1465.80

Standard Error - 132.17

Confidence interval 80% - 1058.26 to 1397.02

Average Black Gum per acre all - 772.36

Confidence interval 80% - 629.06 to 915.66

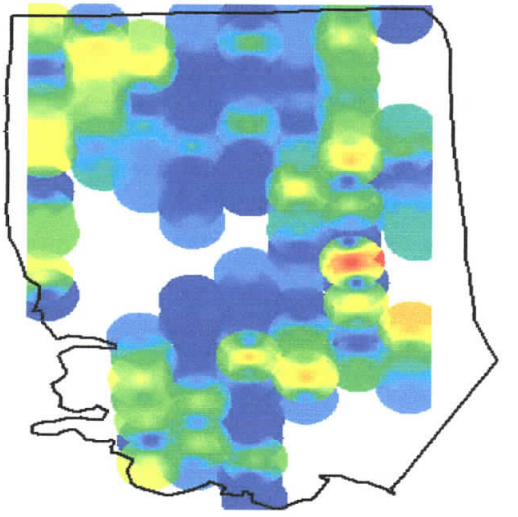
Top five competitors

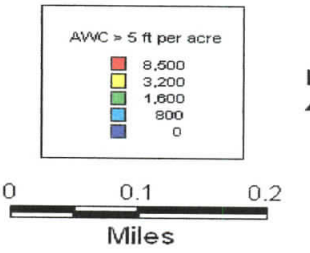
Fetter Bush---------- 4.17%
Bitter Gallberry--------- 3.31%
Wax Myrtle---------- 2.62%
Black Gum---------- 2.52%
Bamboo Brier---------- 2.26%

Total percent cover - 24.02%

Management Recommendation - Level 5

Stand 92
AWC per acre > 5 ft





Stand ID # - 93

Location - Located on the Dare County Range west of H&B between Gator 4 and Smith Road.

Acreage - 185.40

Average AWC per acre all - 2702.70

Standard Deviation - 3287.34

Standard Error - 204.27

Confidence interval 80% - 2440.92 to 2964.48

Average AWC >5' per acre - 1150.58

Standard Deviation - 1923.06

Standard Error - 119.49

Confidence interval 80% - 997.44 to 1236.42

Average Black Gum per acre all - 909.27

Confidence interval 80% - 796.59 to 1021.95

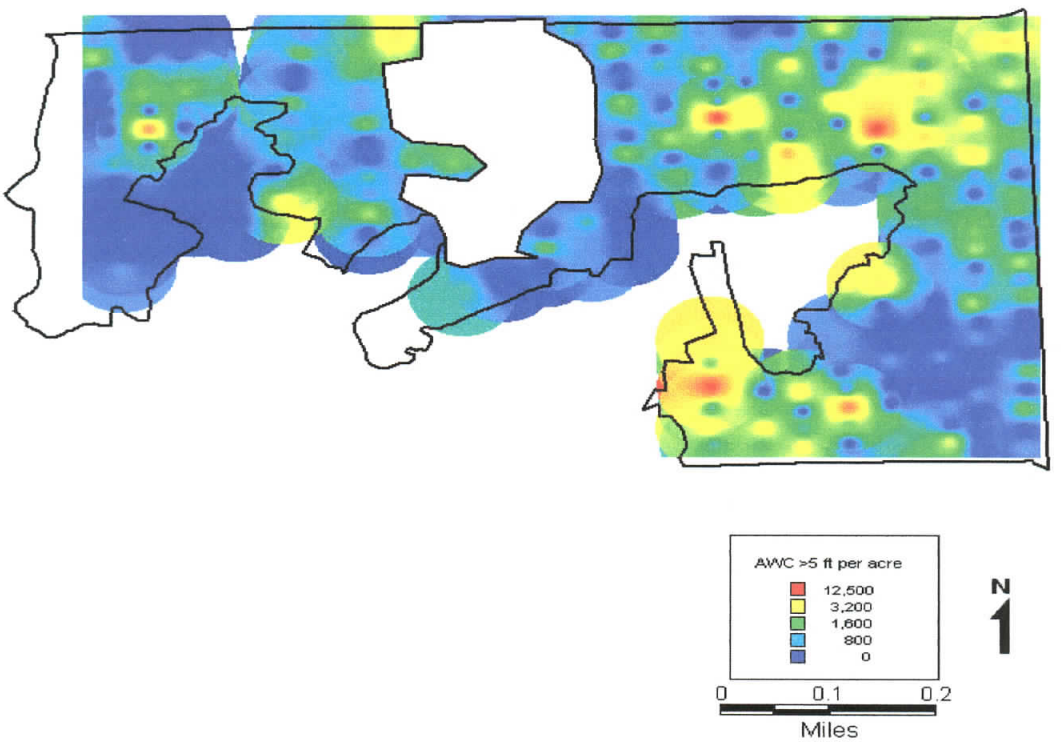
Top five competitors

Fetter Bush---------- 10.76%
Other---------- 8.45%
Wax Myrtle---------- 6.33%
Black Gum---------- 5.40%
Bamboo Brier---------- 5.14%

Total percent cover - 55.47%

Management Recommendation - Level 1

Stand 93
AWC per acre > 5 ft



Stand ID # - 94

Location - Jointly owned. Located west of H&B between Smith Road and Gator 3.

Acreage - 261.40

Average AWC per acre all - 3938.10

Standard Deviation - 3958.13

Standard Error - 386.27

Confidence interval 80% - 3443.07 to 4433.13

Average AWC >5' per acre - 1614.29

Standard Deviation - 1972.48

Standard Error - 192.49

Confidence interval 80% - 1367.70 to 1860.98

Average Black Gum per acre all - 1676.19

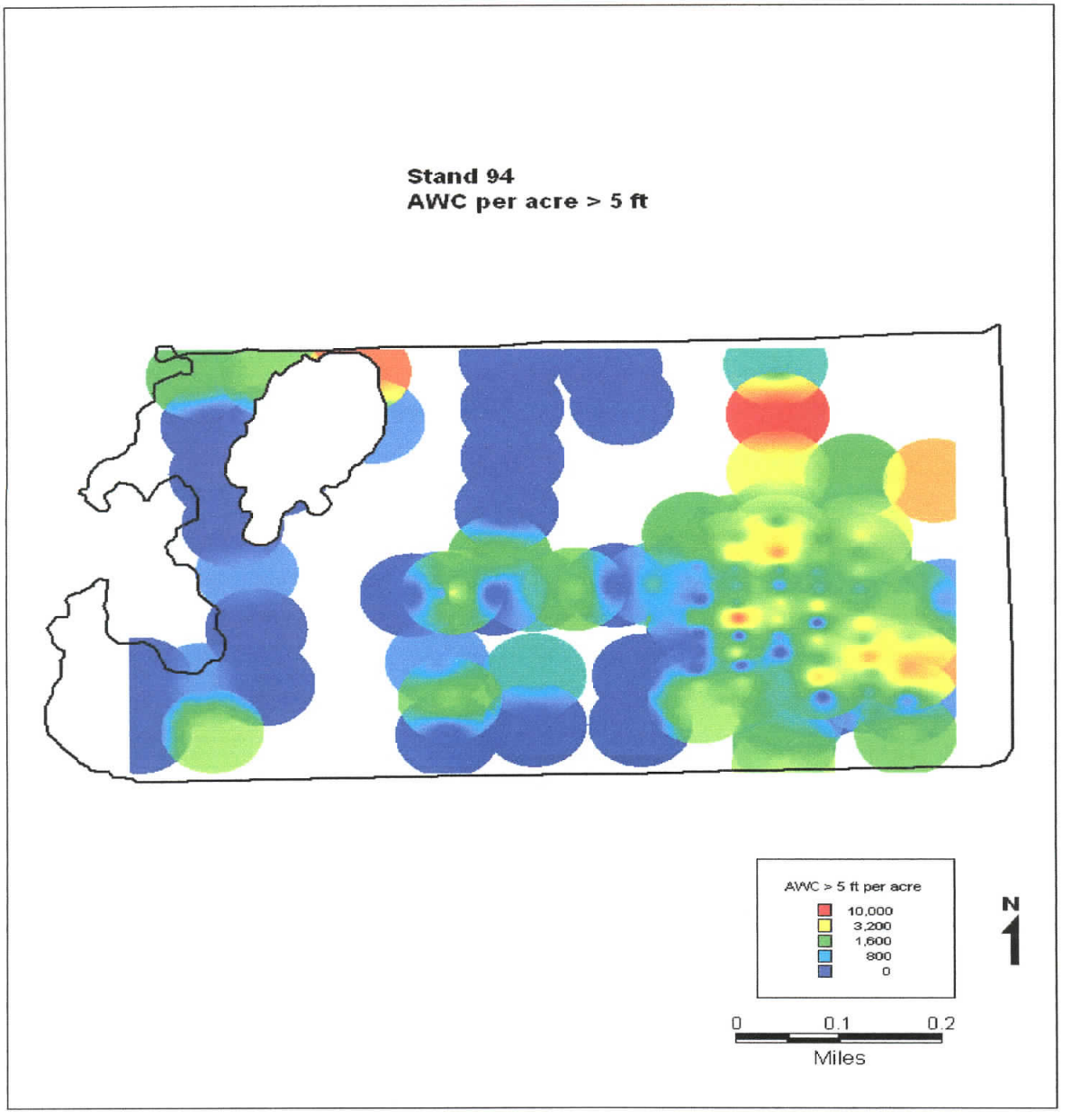
Confidence interval 80% - 1446.59 to 1905.79

Top five competitors

Black Gum---------- 7.40%
Wax Myrtle---------- 6.55%
Fetter Bush----------6.19%
Green Brier---------- 3.86%
Red Maple---------- 3.71%

Total percent cover - 39.24%

Management Recommendation - Level 2


Stand 94
AWC per acre > 5 ft
AWC > 5 ft per acre
10,000
3,200
1,600
800
0
N
0
0.1
0.2
Miles

Stand ID # - 95

Location - Jointly owned. Located west of H&B between Gator 2 and Gator 3.

Acreage - 255.70

Average AWC per acre all - 6435.11

Standard Deviation - 7492.70

Standard Error - 377.96

Confidence interval 80% - 5950.74 to 6919.48

Average AWC >5' per acre - 2326.97

Standard Deviation - 3027.19

Standard Error - 152.70

Confidence interval 80% - 2131.28 to 2522.66

Average Black Gum per acre all - 699.75

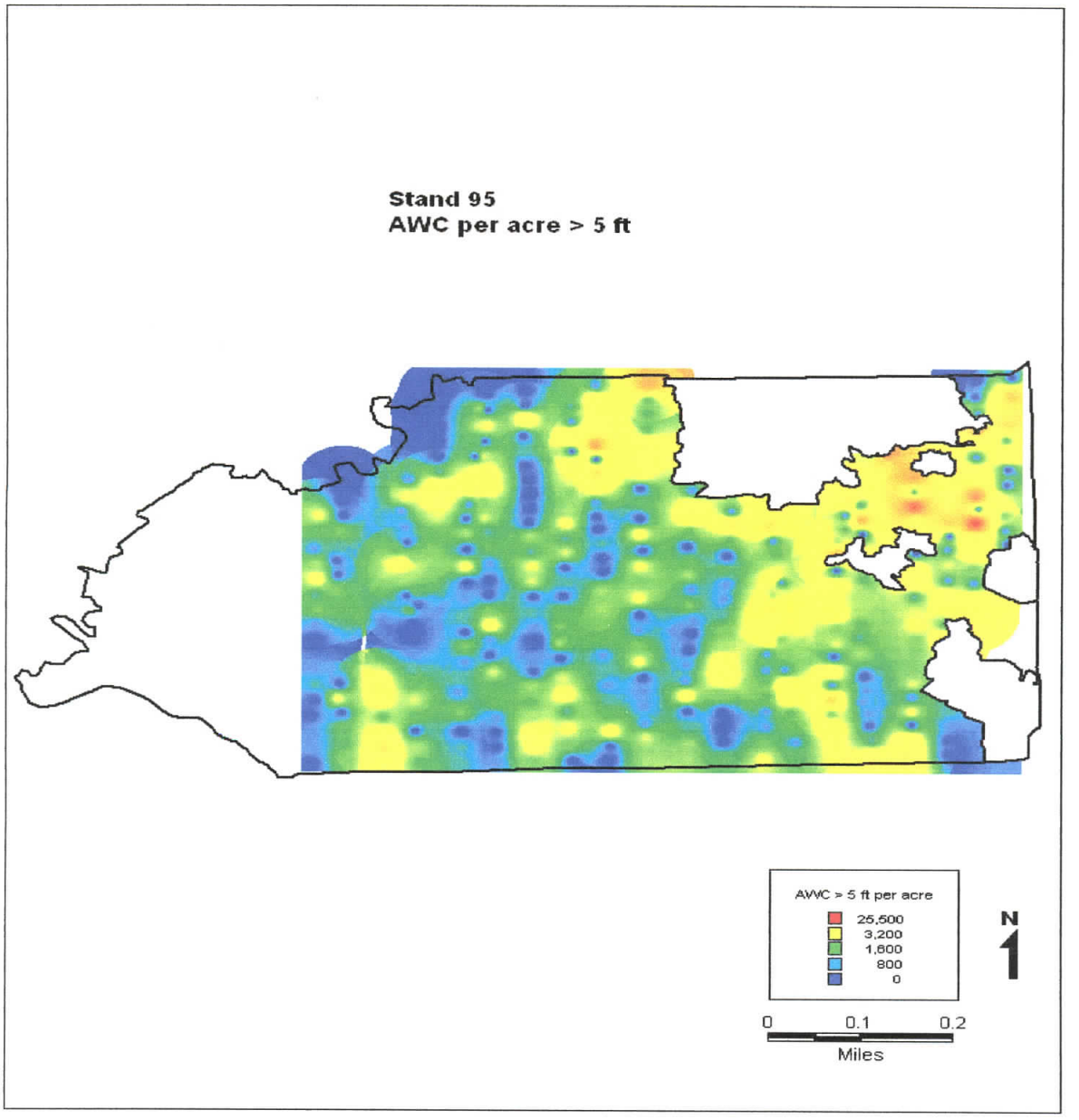
Confidence interval 80% - 620.27 to 779.23

Top five competitors

Fetter Bush---------- 15.60%
Other---------- 10.18%
Wax Myrtle---------- 8.48%
Bamboo Brier---------- 7.43%
Red Maple---------- 5.20%

Total percent cover - 71.62%

Management Recommendation - Level 1


Stand 95
AWC per acre > 5 ft
AWC > 5 ft per acre
25,500
3,200
1,600
800
0
N
1
0
0.1
0.2
Miles

Stand ID # - 96

Location - Located on USFWS property west of H&B Road between Gator 1 and Gator 2.

Acreage - 98.28

Average AWC per acre all - 7583.83

Standard Deviation - 8624.82

Standard Error - 667.41

Confidence interval 80% - 6728.51 to 8439.15

Average AWC >5' per acre - 3949.10

Standard Deviation - 5818.96

Standard Error - 450.28

Confidence interval 80% - 3372.04 to 4526.16

Average Black Gum per acre all - 455.09

Confidence interval 80% - 364.37 to 545.81

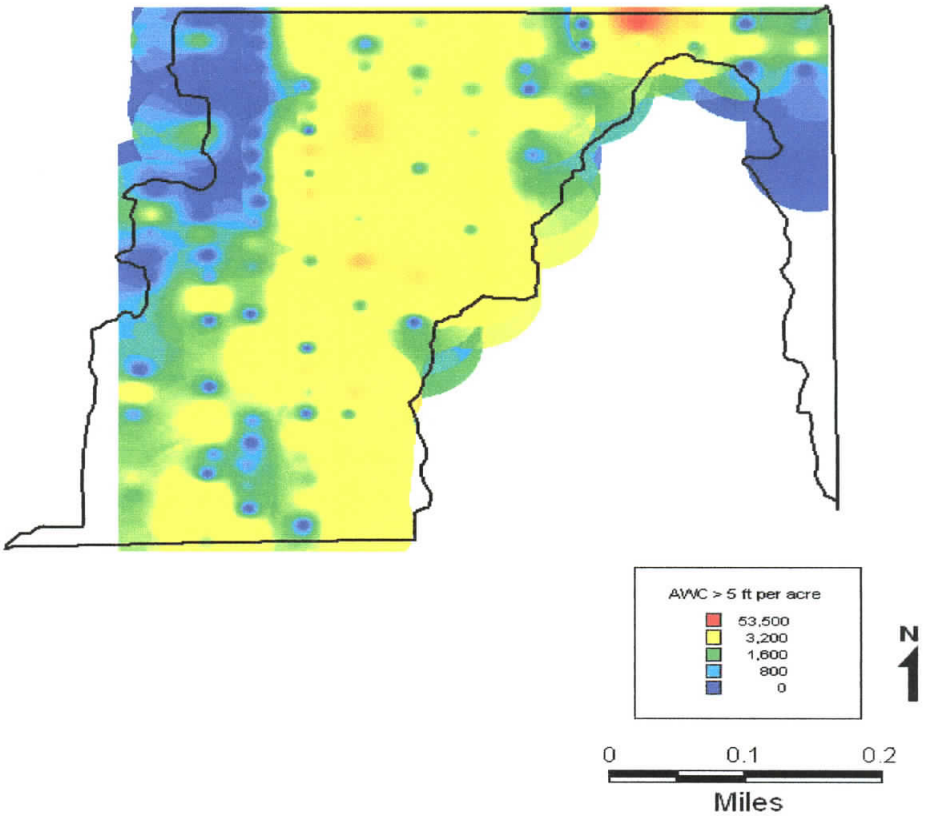
Top five competitors

Fetter Bush---------- 17.75%
Other---------- 6.44%
Bamboo Brier---------- 6.03%
Green Brier---------- 3.97%
Wax Myrtle---------- 3.38%

Total percent cover - 53.38%

Management Recommendation - Level 1

Stand 96
AWC per acre > 5 ft



Stand ID # - 97

Location - Located on USFWS property west of H&B between Gator 1 and Gator 5.

Acreage - 51.38

Average AWC per acre all - 5810.00

Standard Deviation - 5718.03

Standard Error - 571.80

Confidence interval 80% - 5077.21 to 6542.79

Average AWC >5' per acre - 2200.00

Standard Deviation - 2593.70

Standard Error - 259.37

Confidence interval 80% - 1867.60 to 2532.40

Average Black Gum per acre all - 450.00

Confidence interval 80% - 327.98 to 572.02

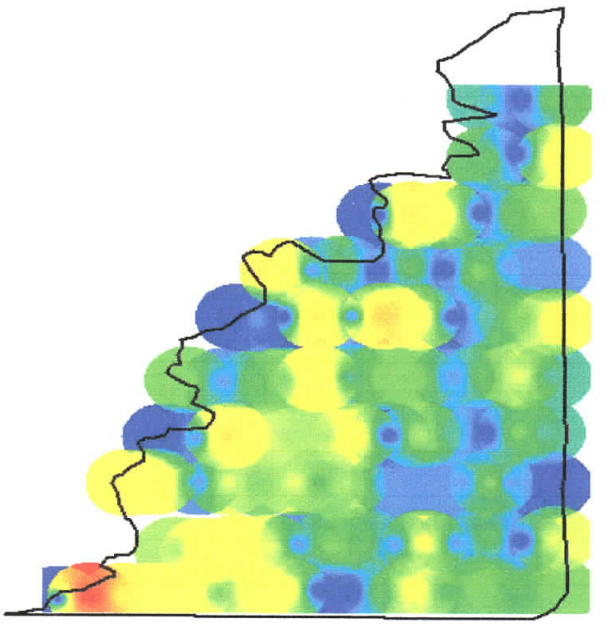
Top five competitors

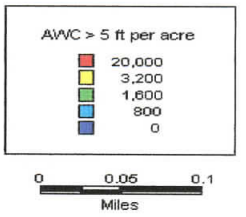
Fetter Bush---------- 16.30%
Wax Myrtle---------- 14.93%
Bamboo Brier---------- 11.25%
Gallberry---------- 3.45%
Green Brier---------- 3.20%

Total percent cover - 63.73%

Management Recommendation - Level 1

Stand 97
AWC per acre > 5 ft





Stand ID # - 98

Location - Located on the Dare County range south of Richmond Road, east of Gibbs Road.

Acreage - 87.02

Average AWC per acre all - 3560.28

Standard Deviation - 4501.38

Standard Error - 379.08

Confidence interval 80% - 3074.46 to 4046.10

Average AWC >5' per acre - 1503.55

Standard Deviation - 1990.60

Standard Error - 167.64

Confidence interval 80% - 1288.71 to 1718.39

Average Black Gum per acre all - 1024.82

Confidence interval 80% - 831.61 to 1218.03

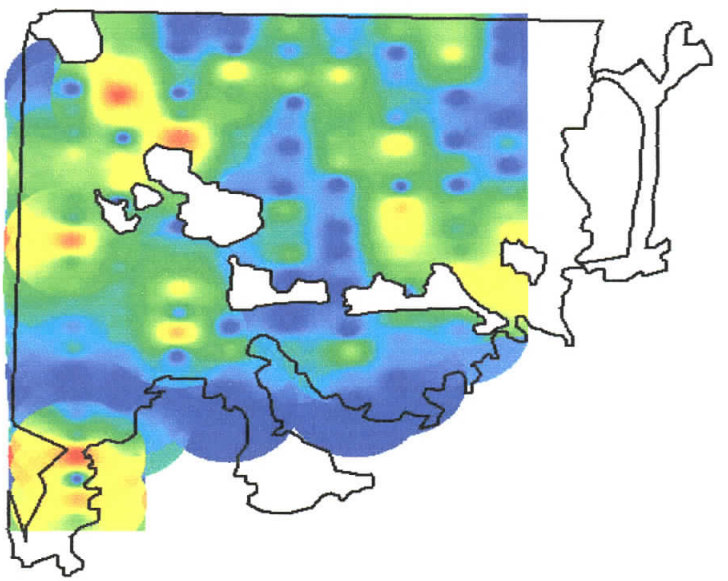
Top five competitors

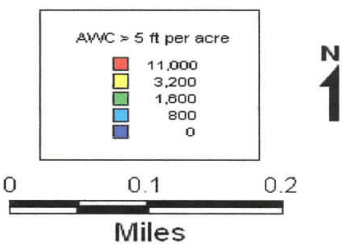
Fetter Bush---------- 14.13%
Red Maple---------- 9.15%
Other---------- 6.24%
Black Gum---------- 5.59%
Gallberry---------- 5.43%

Total percent cover - 58.14%

Management Recommendation - Level 1

Stand 98
AWC per acre > 5 ft





Stand ID # - 99

Location - Located on USFWS property north of Gator 5.

Acreage - 14.35

Average AWC per acre all - 4416.67

Standard Deviation - 5879.30

Standard Error - 1385.76

Confidence interval 80% - 2640.74 to 6192.60

Average AWC >5' per acre - 2055.56

Standard Deviation - 2369.47

Standard Error - 558.49

Confidence interval 80% - 1339.83 to 2771.29

Average Black Gum per acre all - 111.11

Confidence interval 80% - 28.30 to 193.92

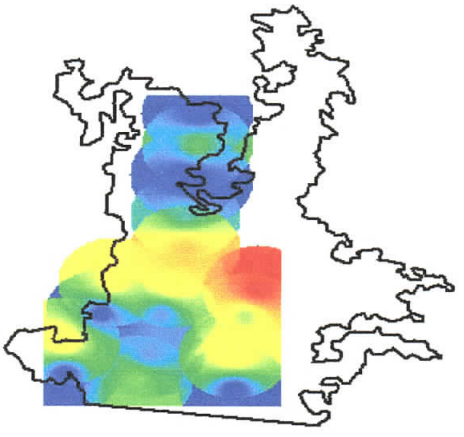
Top five competitors

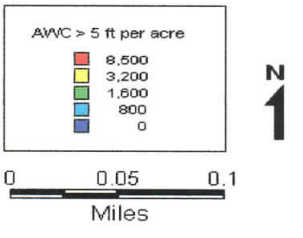
Blueberry---------- 19.17%
Green Brier---------- 15.00%
Other---------- 13.06%
Wax Myrtle---------- 12.64%
Bitter Gallberry--------- 7.78%

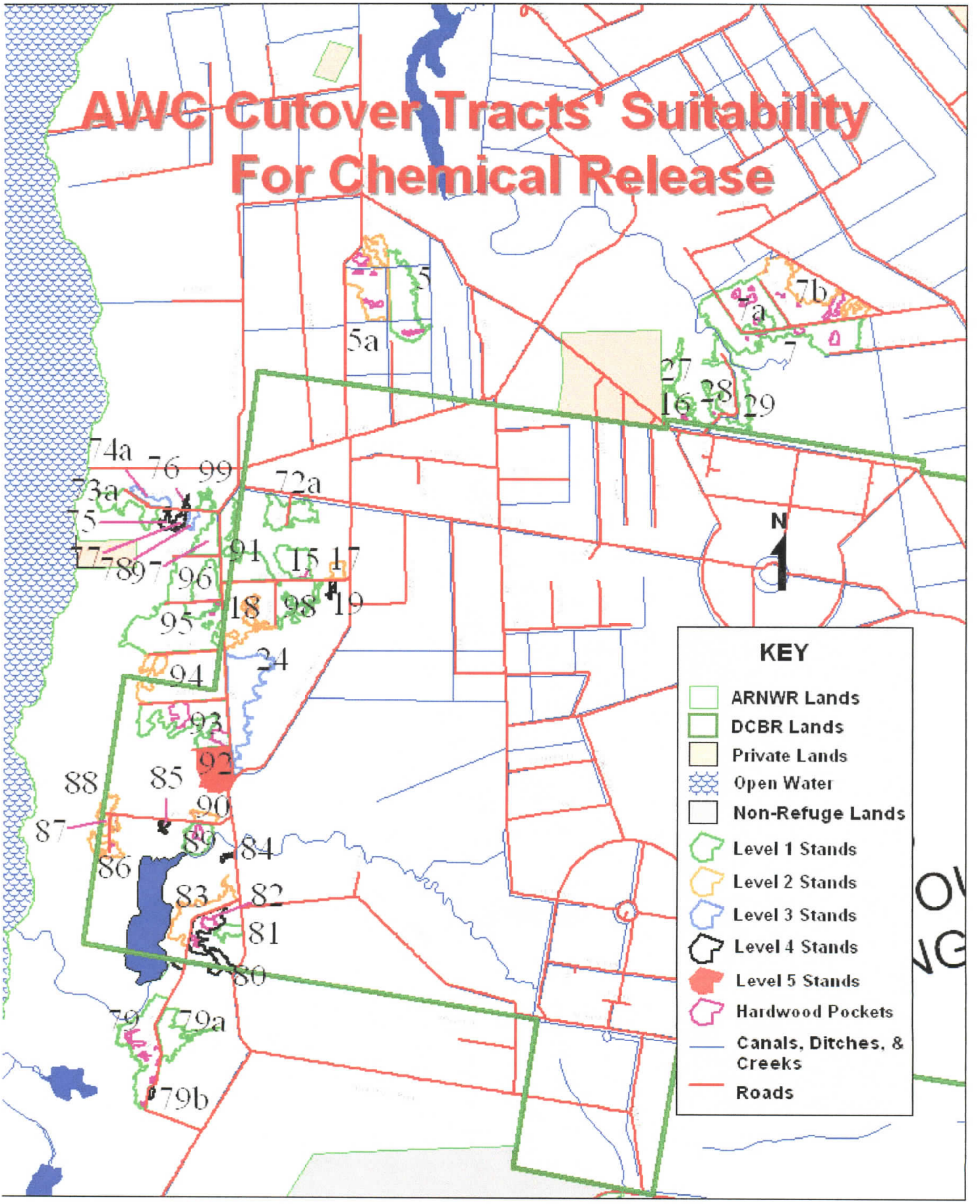
Total percent cover - 70.56%

Management Recommendation - Level 1

Stand 99
AWC per acre > 5 ft






AWC Cutover Tracts' Suitability
For Chemical Release
KEY
ARNWR Lands
DCBR Lands
Private Lands
Open Water
Non-Refuge Lands
Level 1 Stands
Level 2 Stands
Level 3 Stands
Level 4 Stands
Level 5 Stands
Hardwood Pockets
Canals, Ditches, & Creeks
Roads
N

Stand ID # - 7

Number of plots - 50

Average AWC per acre all - 1540.00

Standard Deviation - 1609.41

Standard Error - 227.61

Confidence interval 80% - 1248.31 to 1831.69

Average AWC >5' per acre - 1530.00

Standard Deviation - 1614.38

Standard Error - 228.31

Confidence interval 80% - 1237.41 to 1822.59

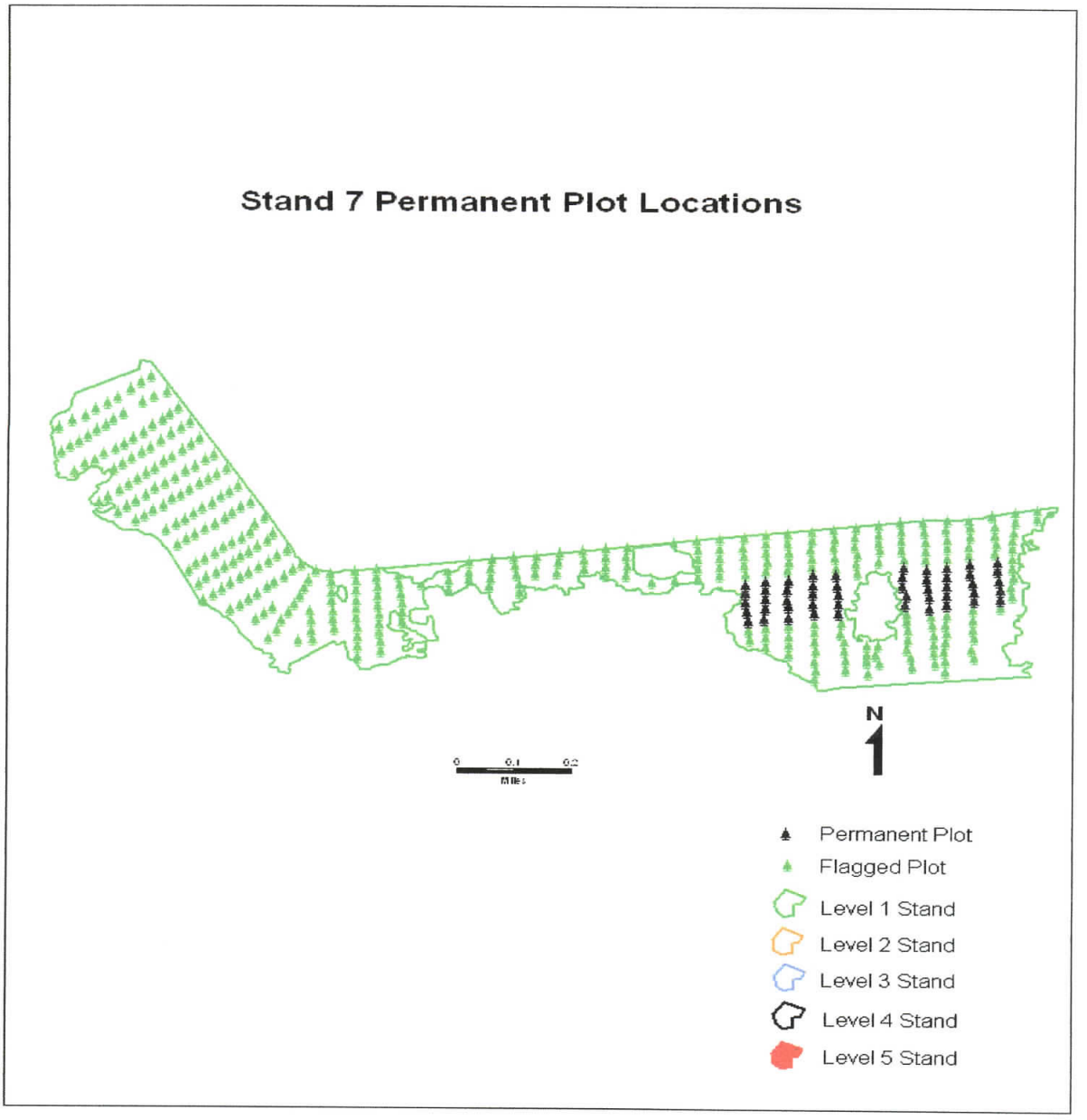
Average Black Gum per acre all - 10.00

Confidence interval 80% - -2.82 to 22.82

Top five competitors

Red Bay---------- 15.65%
Fetter Bush---------- 10.60%
Red Maple---------- 9.60%
Bitter Gallberry---------- 7.90%
Sweet Pepper Bush----- 7.20%

Total percent cover - 59.70%


Stand 7 Permanent Plot Locations
N
1
Permanent Plot
Flagged Plot
Level 1 Stand
Level 2 Stand
Level 3 Stand
Level 4 Stand
Level 5 Stand

Stand ID # - 7b

Number of plots - 50

Average AWC per acre all - 4470.00

Standard Deviation - 4455.46

Standard Error - 630.10

Confidence interval 80% - 3662.50 to 5277.50

Average AWC >5' per acre - 3270.00

Standard Deviation - 3952.80

Standard Error - 559.01

Confidence interval 80% - 2253.60 to 3986.40

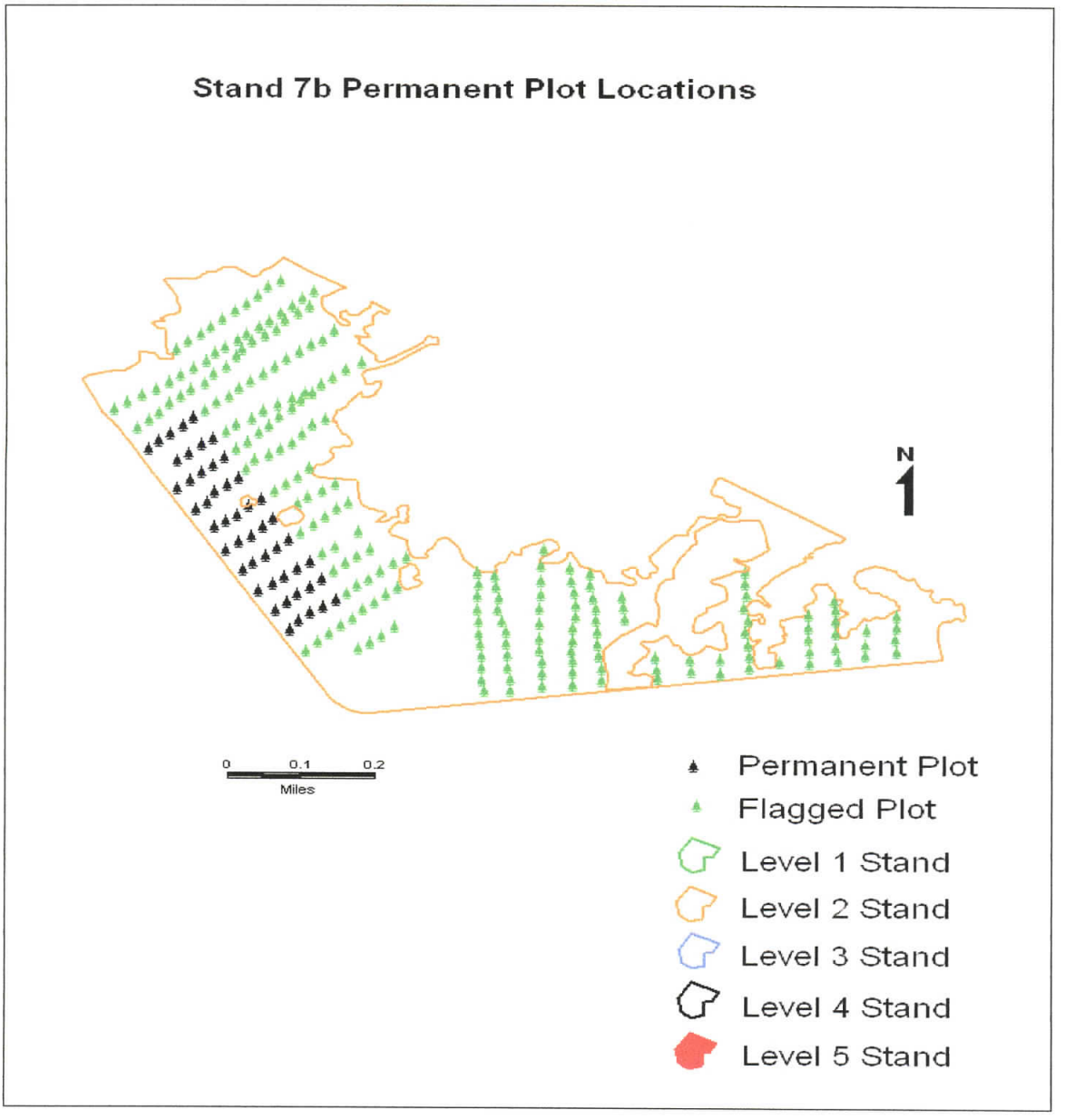
Average Black Gum per acre all - 170.00

Confidence interval 80% - 86.89 to 253.11

Top five competitors

Fetter Bush----------12.55%
Wax Myrtle---------- 5.75%
Other---------- 4.20%
Bitter Gallberry----------3.75%
Blueberry----------2.85%

Total percent cover - 37.00%


Stand 7b Permanent Plot Locations
N
1
0
0.1
0.2
Miles
Permanent Plot
Flagged Plot
Level 1 Stand
Level 2 Stand
Level 3 Stand
Level 4 Stand
Level 5 Stand

Stand ID # - 17

Number of plots - 50

Average AWC per acre all - 2800.00

Standard Deviation - 2725.54

Standard Error - 385.45

Confidence interval 80% - 2306.03 to 3293.97

Average AWC >5' per acre - 1080.00

Standard Deviation - 1716.78

Standard Error - 242.79

Confidence interval 80% - 768.85 to 1391.15

Average Black Gum per acre all - 1140.00

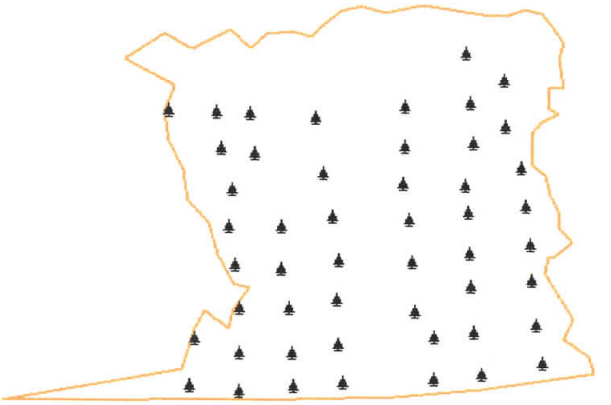
Confidence interval 80% - 798.45 to 1481.55

Top five competitors

Fetter Bush---------- 21.25%
Other---------- 12.25%
Red Maple---------- 11.50%
Black Gum---------- 8.35%
Gallberry---------- 8.30%

Total percent cover - 84.35%

Stand 17 Permanent Plot Locations



N

1

0 0.05 0.1

Miles

Permanent Plot

Flagged Plot

Level 1 Stand

Level 2 Stand

Level 3 Stand

Level 4 Stand

Level 5 Stand

Stand ID # - 19

Number of plots - 17

Average AWC per acre all - 4000.00

Standard Deviation - 6557.44

Standard Error - 1590.41

Confidence interval 80% - 1961.81 to 6038.19

Average AWC >5' per acre - 470.59

Standard Deviation - 874.47

Standard Error - 212.09

Confidence interval 80% - 198.78 to 742.40

Average Black Gum per acre all - 765.00

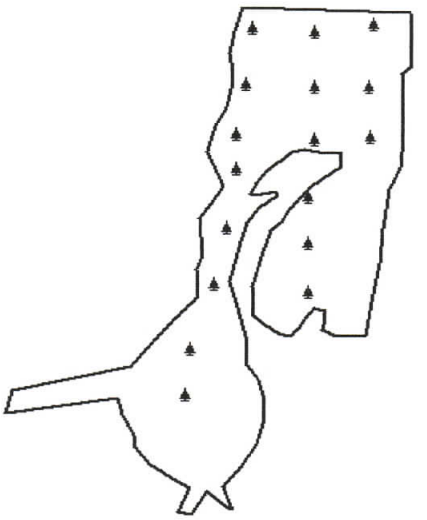
Confidence interval 80% - 346.12 to 1183.88

Top five competitors

Red Maple---------- 22.06%
Other---------- 14.41%
Fetter Bush---------- 14.26%
Smilax Walteri---------- 10.88%
Red Bay---------- 7.79%

Total percent cover - 81.76%

Stand 19 Permanent Plot Locations



N

0 0.05 0.1

Miles

- Permanent Plot
- Flagged Plot
- Level 1 Stand
- Level 2 Stand
- Level 3 Stand
- Level 4 Stand
- Level 5 Stand

Stand ID # - 24

Number of plots - 50

Average AWC per acre all - 1430.00

Standard Deviation - 1913.99

Standard Error - 270.68

Confidence interval 80% - 1083.11 to 1776.89

Average AWC >5' per acre - 950.00

Standard Deviation - 1217.43

Standard Error - 172.17

Confidence interval 80% - 729.35 to 1170.65

Average Black Gum per acre all - 1940.00

Confidence interval 80% - 1420.35 to 2459.65

Top five competitors

Black Gum---------- 5.90%
Fetter Bush----------5.05%
Wax Myrtle---------- 4.45%
Smilax Walteri---------- 4.05%
Smilax Laurifolia-------- 2.25%

Total percent cover - 30.50%

Stand 24 Permanent Plot Locations

Stand ID # - 28

Number of plots - 48

Average AWC per acre all - 12653.06

Standard Deviation - 18417.10

Standard Error - 2631.01

Confidence interval 80% - 9281.28 to 16024.84

Average AWC >5' per acre - 6510.20

Standard Deviation - 12007.16

Standard Error - 1715.31

Confidence interval 80% - 4311.95 to 8708.45

Average Black Gum per acre all - 367.35

Confidence interval 80% - 219.30 to 515.40

Top five competitors

Fetter Bush---------- 25.82%
Gallberry---------- 9.23%
Other---------- 8.11%
Red Bay---------- 6.68%
Bitter Gallberry---------- 6.28%

Total percent cover - 70.31%

Stand 28 Permanent Plot Locations

Stand ID # - 79

Number of plots - 50

Average AWC per acre all - 8140.00

Standard Deviation - 6092.85

Standard Error - 861.66

Confidence interval 80% - 7035.74 to 9244.26

Average AWC >5' per acre - 1750.00

Standard Deviation - 1793.55

Standard Error - 253.65

Confidence interval 80% - 1424.94 to 2075.06

Average Black Gum per acre all - 190.00

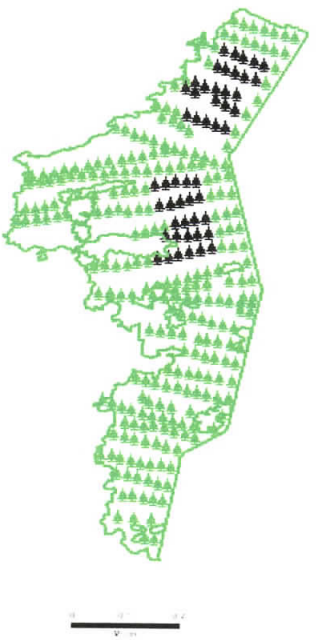
Confidence interval 80% - 81.86 to 298.14

Top five competitors

Bitter Gallberry---------- 11.00%
Other---------- 9.40%
Wax Myrtle---------- 8.95%
Fetter Bush----------8.90%
Red Maple---------- 3.45%

Total percent cover - 52.80%

Stand 79 Permanent Plot Locations



N

1

Permanent Plot
Flagged Plot
Level 1 Stand
Level 2 Stand
Level 3 Stand
Level 4 Stand
Level 5 Stand

Stand ID # - 79a

Number of plots - 50

Average AWC per acre all - 4540.00

Standard Deviation - 4422.62

Standard Error - 625.45

Confidence interval 80% - 3738.45 to 5341.55

Average AWC >5' per acre - 1700.00

Standard Deviation - 1859.89

Standard Error - 263.03

Confidence interval 80% - 1362.92 to 2037.08

Average Black Gum per acre all - 700.00

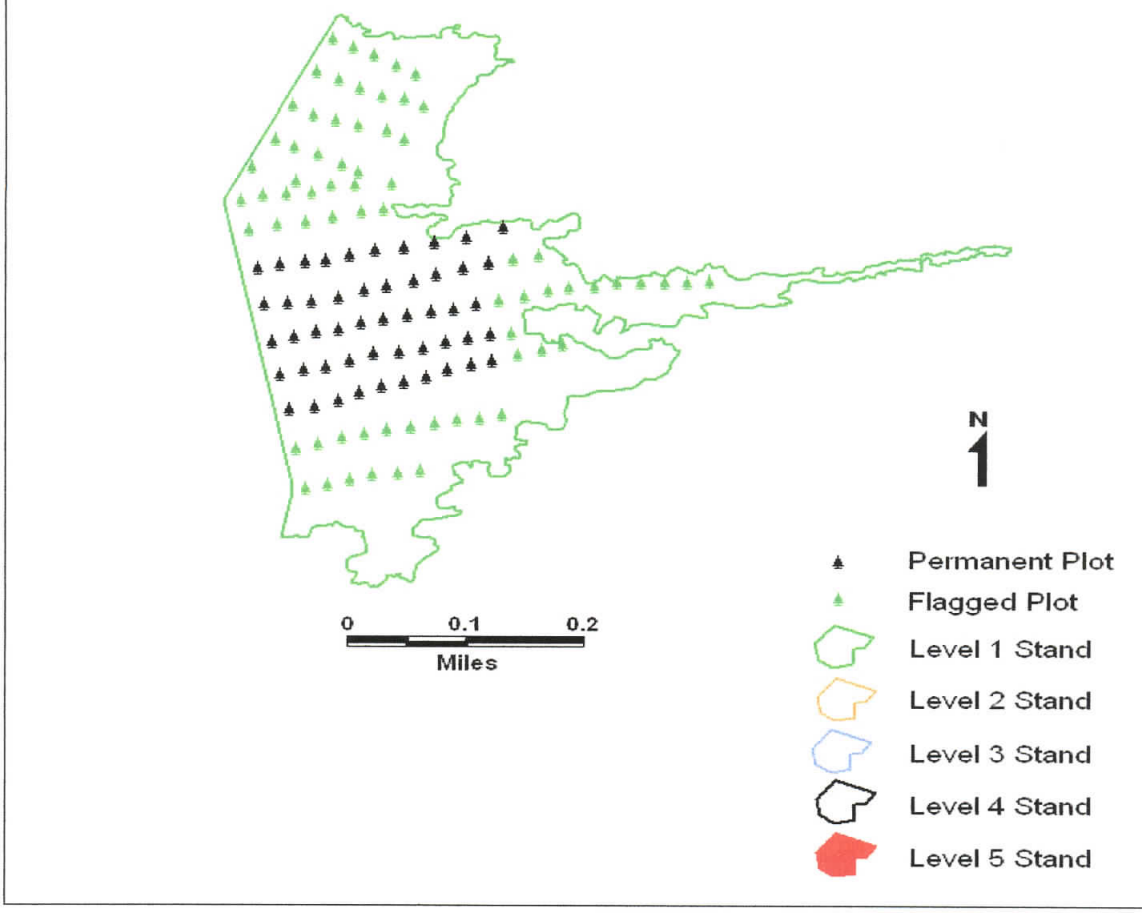
Confidence interval 80% - 443.69 to 956.31

Top five competitors

Bitter Gallberry---------- 10.15%
Fetter Bush----------8.45%
Wax Myrtle---------- 8.40%
Other---------- 6.40%
Red Maple---------- 4.35%

Total percent cover - 54.05%

Stand 79a Permanent Plot Locations



Stand ID # - 94

Number of plots - 50

Average AWC per acre all - 4330.00

Standard Deviation - 3752.02

Standard Error - 530.62

Confidence interval 80% - 3649.99 to 5010.01

Average AWC >5' per acre - 1910.00

Standard Deviation - 1869.98

Standard Error - 264.46

Confidence interval 80% - 1571.09 to 2248.91

Average Black Gum per acre all - 2340.00

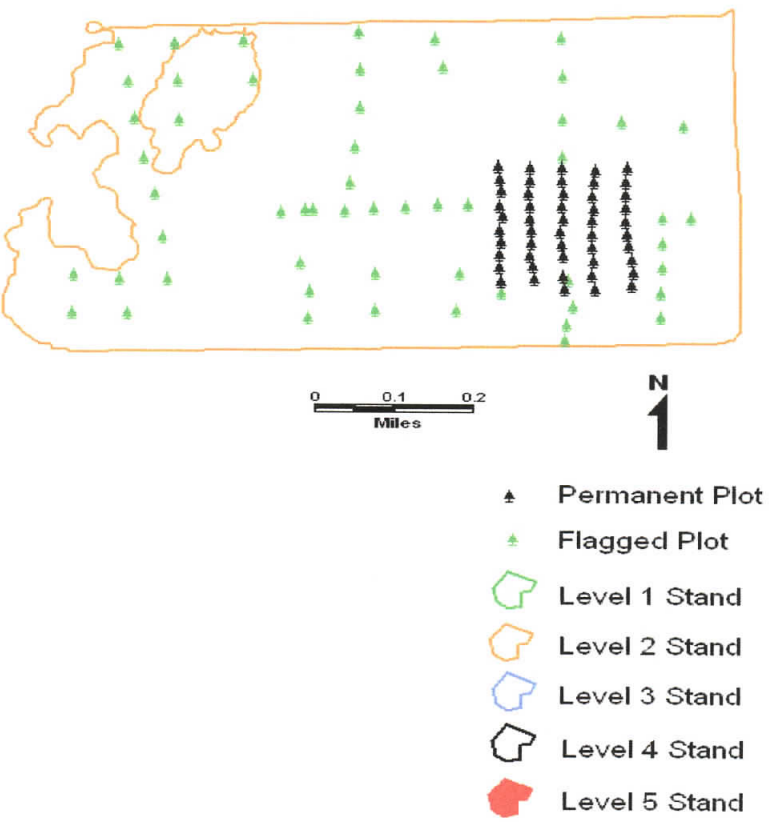
Confidence interval 80% - 1958.84 to 2721.16

Top five competitors

Black Gum---------- 11.10%
Fetter Bush----------10.20%
Wax Myrtle---------- 6.75%
Smilax Walteri----------3.25%
Sweet Pepper Bush----- 2.70%

Total percent cover - 40.50%

Stand 94 Permanent Plot Locations



Stand ID # - 95

Number of plots - 50

Average AWC per acre all - 5740.00

Standard Deviation - 5004.32

Standard Error - 707.72

Confidence interval 80% - 4833.02 to 6646.98

Average AWC >5' per acre - 1910.00

Standard Deviation - 1872.71

Standard Error - 264.84

Confidence interval 80% - 1570.59 to 2249.41

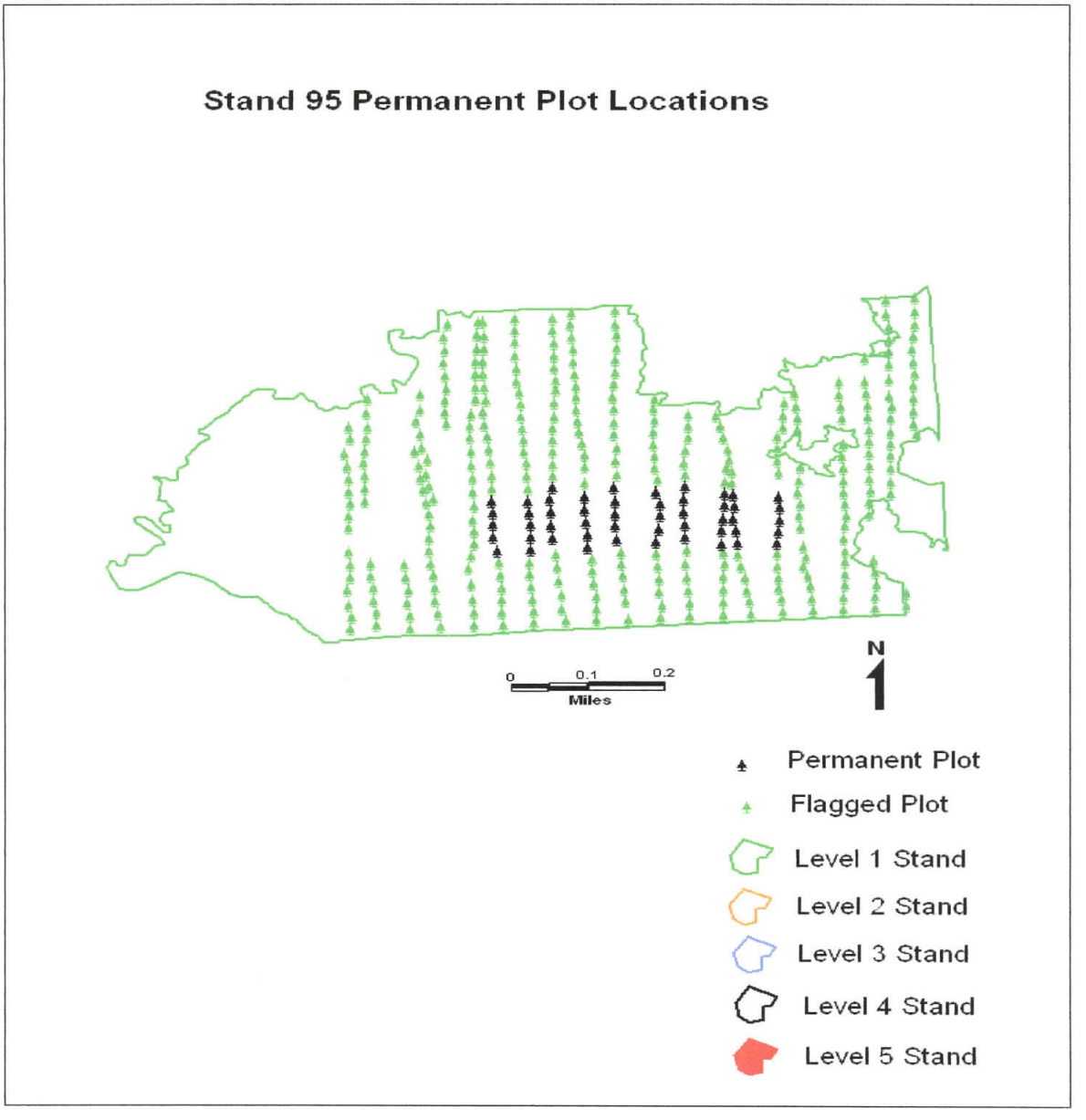
Average Black Gum per acre all - 570.00

Confidence interval 80% - 400.21 to 739.79

Top five competitors

Other---------- 18.30%
Fetter Bush----------14.15%
Wax Myrtle---------- 8.90%
Smilax Laurifolia-------- 6.50%
Sweet Pepper Bush----- 4.35%

Total percent cover - 68.40%


Stand 95 Permanent Plot Locations
0
0.1
0.2
Miles
N
Permanent Plot
Flagged Plot
Level 1 Stand
Level 2 Stand
Level 3 Stand
Level 4 Stand
Level 5 Stand

Stand ID # - 99

Number of plots - 18

Average AWC per acre all - 4416.67

Standard Deviation - 5879.30

Standard Error - 1385.76

Confidence interval 80% - 2640.74 to 6192.60

Average AWC >5' per acre - 2055.56

Standard Deviation - 2369.47

Standard Error - 558.49

Confidence interval 80% - 1339.83 to 2771.29

Average Black Gum per acre all - 111.11

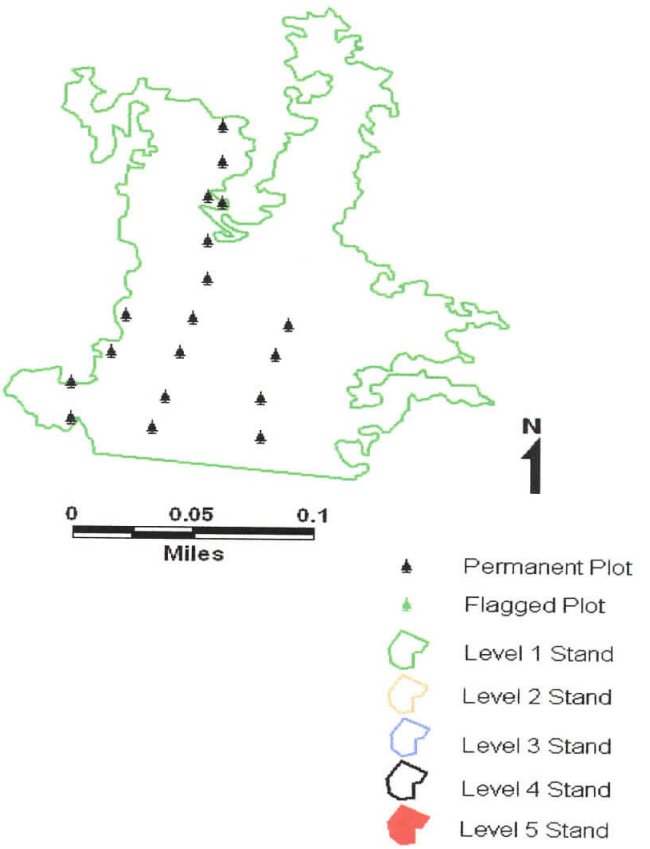
Confidence interval 80% - 28.30 to 193.92

Top five competitors

Blueberry---------- 19.17%
Smilax Walteri---------- 15.00%
Other---------- 13.06%
Wax Myrtle---------- 12.64%
Bitter Gallberry---------- 7.78%

Total percent cover - 70.56%

Stand 99 Permanent Plot Locations



Scientific Name	Common Name
Acer rubrum	Red Maple
Andropogon virginicus	Broom Sedge
Clethra alnifolia	Sweet Pepper Bush
Ilex coriacea	Gallberry
Ilex glabra	Bitter Gallberry
Lyonia lucida	Fetter Bush
Myrica cerifera	Wax Myrtle
Nyssa aquatica	Black Gum
Persea borbonia	Red Bay
Scirpus cyperinus	Wool Grass
Smilax laurifolia	Bamboo Brier
Smilax rotundifolia	Brown Leaf Brier
Smilax walteri	Green Brier
Typha latifolia	Cattail
Vaccinium	Blueberry